CQ

NOVEMBER, 1947

The Radio Amateurs' Journal

35¢

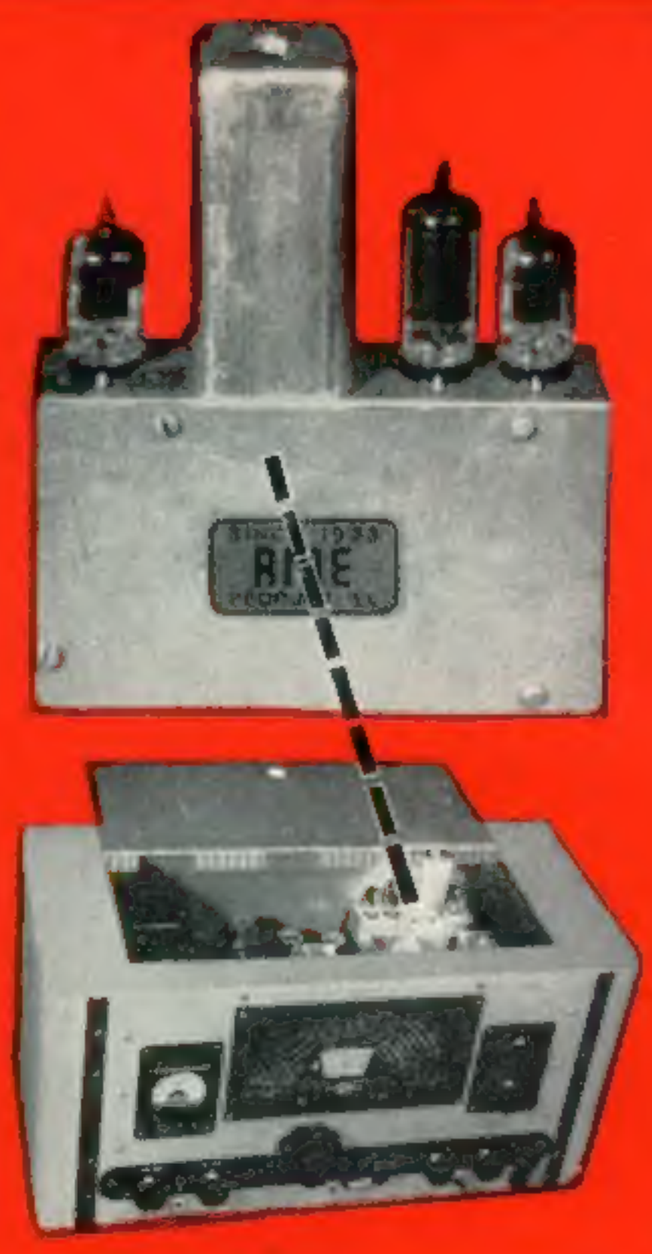
IN THIS ISSUE:

The Varif-A New Receiver for 2 Meters • Operating Characteristics of the 21-mc Band
Converting the SCR-274 Receiver • "Life Insurance in the Shack!" with Color Insert

Published by RADIO MAGAZINES, INC. Subscription $2.50 a year

RME *Announces...*

THREE NEW PRODUCTS!



THE NEW RATIO DETECTOR (NBF4)

For Optimum Narrow Band FM Performance

The new RME NFM Ratio Detector is the solution to high sensitivity and noiseless reception of NFM (narrow band FM). With this plug-in unit and an RME 45 receiver, the noise-reducing advantages of NFM are fully realized. NFM Signals that can't be heard with good AM communications receivers come in loud and clear against a noiseless background.

The new RME NFM RATIO-DETECTOR PLUG-IN UNIT is designed for optimum results with amateur systems where the deviation is only ±2.5 KC. With the unit, equal sensitivity can be enjoyed on AM or NFM. It employs a highly efficient ratio-type detector and a limiter for noise-free reception of NFM signals. The unit is switchable—from AM to NFM at will. For the owners of RME 45's, B Series, there are no soldered connections—simply plug the unit into the detector tube socket. In other model 45's, slight circuit changes can be made at the factory or at official RME service centers. Only RME 45 receivers can employ the unit. RME owners can once again be happy with their choice—for RME equipment stays modern!

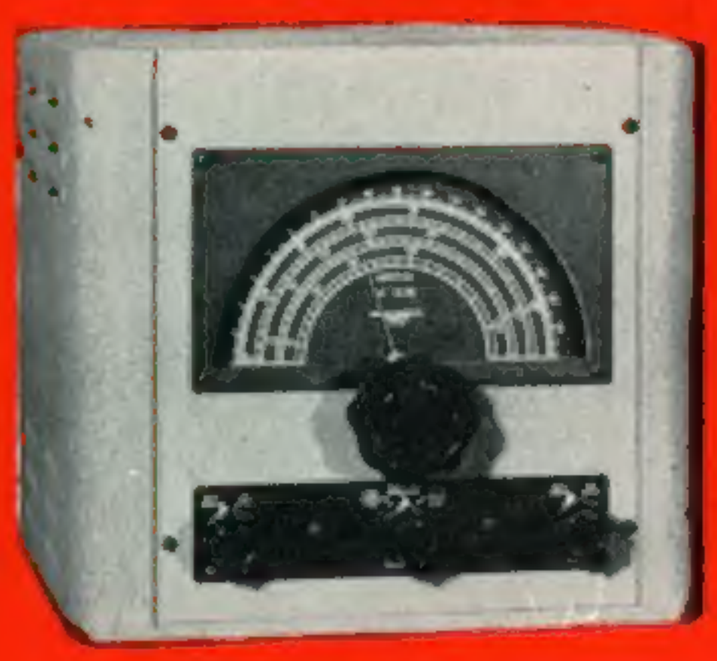
Amateur Net **$19.50**

THE BOOMERANG (MB-3)

A Break-In And Monitoring Device For CW & Fone

Signals come right back to you because of the monitoring features of the "Boomerang." While monitoring your own keying or speech, you'll also enjoy instant break-in operation for c. w. or fone, even on your own frequency. The moment your key is depressed, or the transmitter turned on for fone operation, receiver output is silenced. You'll also hear incoming signals during the keying intervals. The "Boomerang" can be used with any receiver that has a phone jack. Simply plug the "Boomerang" into your fone jack and an AC line. The "Boomerang" makes possible efficient and enjoyable QSO's.

Amateur Net **$22.50**



THE HF 10-20 CONVERTER

For 10-11-15 and 20 Meters

Because of the double conversion system, the HF 10-20 provides outstanding and imageless reception on the above frequencies. And its an especially vital adjunct to those receivers that tune only to 18 mc. or possess inadequate bandspread. The HF 10-20 provides an average of 7.8 linear inches of calibrated bandspread on each of the three bands. An all-gear planetary mechanism is used. Images are non-existent. The output (I. F. frequency) of the HF 10-20 is 7 mc. It can be used with any all-wave or amateur receiver. Features include provision for separate antennae, self-contained power supply, antenna selector switch, band selector and high gain.

Amateur Net **$77.00**

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FINE COMMUNICATIONS EQUIPMENT

RADIO MFG. ENGINEERS, INC.

Peoria 6, Illinois U. S. A.

Positive Voice Recognition!

Your signal is clear and distinct, your voice retains its individuality, you get quick recognition and more QSO's—when you call with the CARDAX. Ideal for DX or rag-chewing.

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Get valuable data on today's most complete microphone line.

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OUTSTANDING FEATURES

- Continuous frequency coverage from 550 kc. to 55 mc. Bandswitching in 5 ranges. Bandspread tuning at any frequency.
- Seven tube superheterodyne (plus rectifier and voltage regulator).
- Automatic Noise Limiter.
- Built-in loudspeaker and A.C. power supply.
- R. F. stage with panel controlled antenna trimmer.
- Operates from 105-130 volts, 50-60 cycles A.C. (Provision for battery operation.)
- Housed in a streamlined gray cabinet.

AMATEUR NET.....$89.50

HERE IT IS—THE NEW NC-57

National NC EST. 1914

To meet the needs of the many hams who have asked for a sensitive, first-rate bandswitching receiver in the lower price bracket, complete with speaker and power supply in one cabinet, the National Company has developed the brand-new NC-57.

The CW operator will enjoy the stable operation and excellent signal-to-noise ratio of the NC-57.

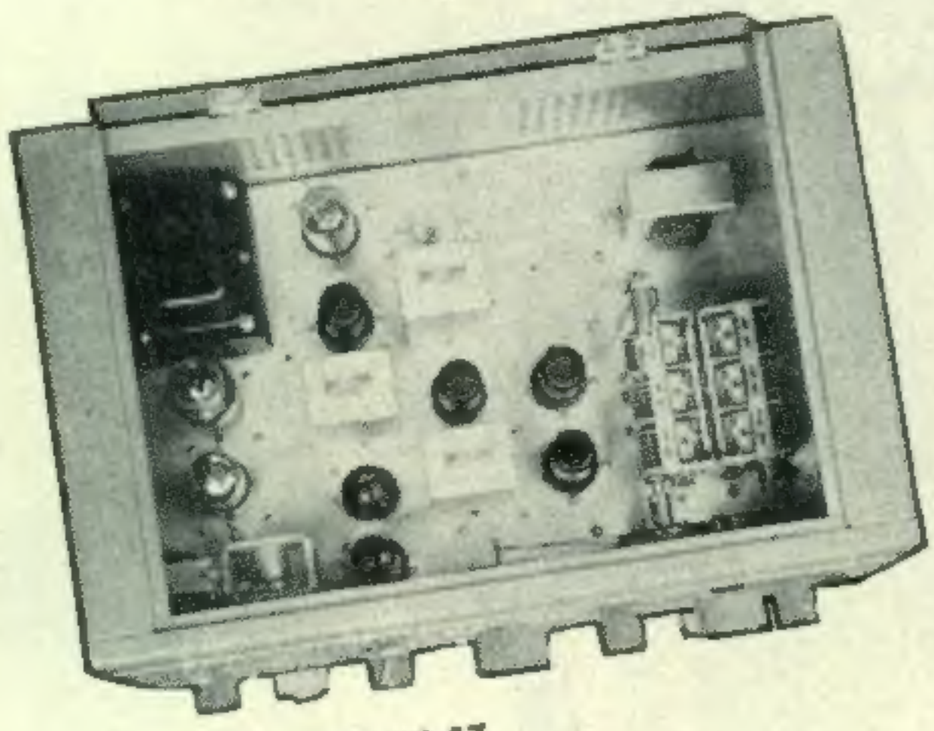
The phone operator will be pleased with the tone quality and selectivity.

The SWL will log DX stations with ease and clarity.

In fact, any operator now operating a communications receiver will find the NC-57 essential as a standby.

In this price class, the new National NC-57 is an outstanding value. See and hear one at your local distributor's ham shack this week.

The SM-57 Signal Strength Meter has been designed as an accessory to be used in conjunction with the NC-57.



INTERIOR OF NC-57

National Company, Inc.
Dept. No. 9
Malden, Mass.

MAKERS OF LIFETIME RADIO EQUIPMENT

CQ

The Radio Amateurs' Journal

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Vol. 3 **NOVEMBER, 1947** **No. 11**

In This Issue

COVER—A new application for an old device, from Lecher wires to waveguides in one easy lesson. W1AIY illustrates a simple and inexpensive arrangement for the measurement of frequencies in the 3-cm region. Full details are given in his article starting on page 28.

Letters 6

Scratchi 8

Zero Bias (*Editorial*) 13

The Varif—A New Receiver for 2 Meters
L. P. Neal, W1OQK, and Herb Wells, W1WS 15

Operating Characteristics of the 21-MC Band
Oliver P. Ferrell 20

Converting the SCR-274N Receiver
Russell F. Sievert, W8OZA 24

Inside the Shack and Workshop 27

Simple Measuring Equipment for Flexible Waveguides
Alfred M. Winchell, W1AIY 28

Norfolk Emergency Net 31

Life Insurance in the Shack
Dr. George J. Nichols, W3JAY 32

Emergency First Aid Rules for Electric Shock 33

The L Network as an Impedance Transformer
F. D. Wells, W6QUC 38

Medium Power Table Top Transmitter
Tom Smith, W6EZS 41

The Other Fellow's Station—W5VV 44

Screen Safety Ballast for Large Beam Tetrodes and Pentodes—*W. W. Smith, W6BCX* 45

V.H.F.-U.H.F. 47

50-mc Honor Roll 48

Monthly DX Predictions 50

DX and Overseas News 52

W.A.Z. Honor Roll 54

The YL's Frequency 58

Parts and Products 60

Advertising Index 100

Model

SX-43

"The hottest ham performance ever at this price . . ." That's the verdict of amateurs who have had a chance to try Hallicrafters new Model SX-43.

This new member of the Hallicrafters line offers continuous coverage from 540 kilocycles to 55 megacycles and has an additional band from 88 to 108 megacycles. AM reception is provided on all bands, except band 6, CW on the four lower bands and FM on frequencies above 44 megacycles. In the band of 44 to 55 Mc., wide band FM or narrow band AM just right for narrow band FM reception is provided.

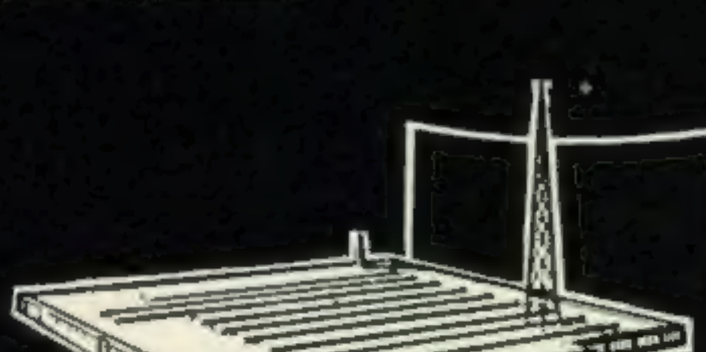
One stage of high gain tuned RF and a type 7F8 dual triode converter assure an exceptionally good signal-to-noise ratio. Image ratio on the AM channel on band 5 (44 to 55 Mc.) is excellent as the receiver is used as a double superheterodyne. The new Hallicrafters dual IF transformers provide a 455 kilocycle IF channel for operating frequencies below 44 megacycles and a 10.7 megacycle IF channel for the VHF bands. Two IF stages are used on the four lower bands and a third stage is added above 44 megacycles. Switching of IF frequencies is automatic. The separate electrical bandspread dial is calibrated for the amateur 3.5, 7, 14, and 28 megacycle bands.

Every important feature for excellent communications receiver performance is included in the SX-43.

$169.50

FEATURES FOUND IN NO OTHER RECEIVER AT THIS PRICE

- ALL ESSENTIAL AMATEUR FREQUENCIES FROM 540 kc TO 108 MC
- AM - FM - CW RECEPTION
- IN BAND OF 44 TO 55 MC: WIDE BAND FM OR NARROW BAND AM . . . JUST RIGHT FOR NARROW BAND FM RECEPTION
- CRYSTAL FILTER AND EXPANDING IF CHANNEL PROVIDE 4 VARIATIONS OF SELECTIVITY ON LOWER BANDS
- TEMPERATURE COMPENSATION FOR FREEDOM FROM DRIFT
- SERIES TYPE NOISE LIMITER
- PERMEABILITY ADJUSTED "MICROSET" INDUCTANCES IN THE RF CIRCUITS
- SEPARATE RF AND AF GAIN CONTROLS
- EXCEPTIONALLY GOOD SIGNAL-TO-NOISE RATIO
- SEPARATE ELECTRICAL BANDSPREAD CALIBRATED FOR THE AMATEUR 3.5, 7, 14, AND 28 Mc BANDS



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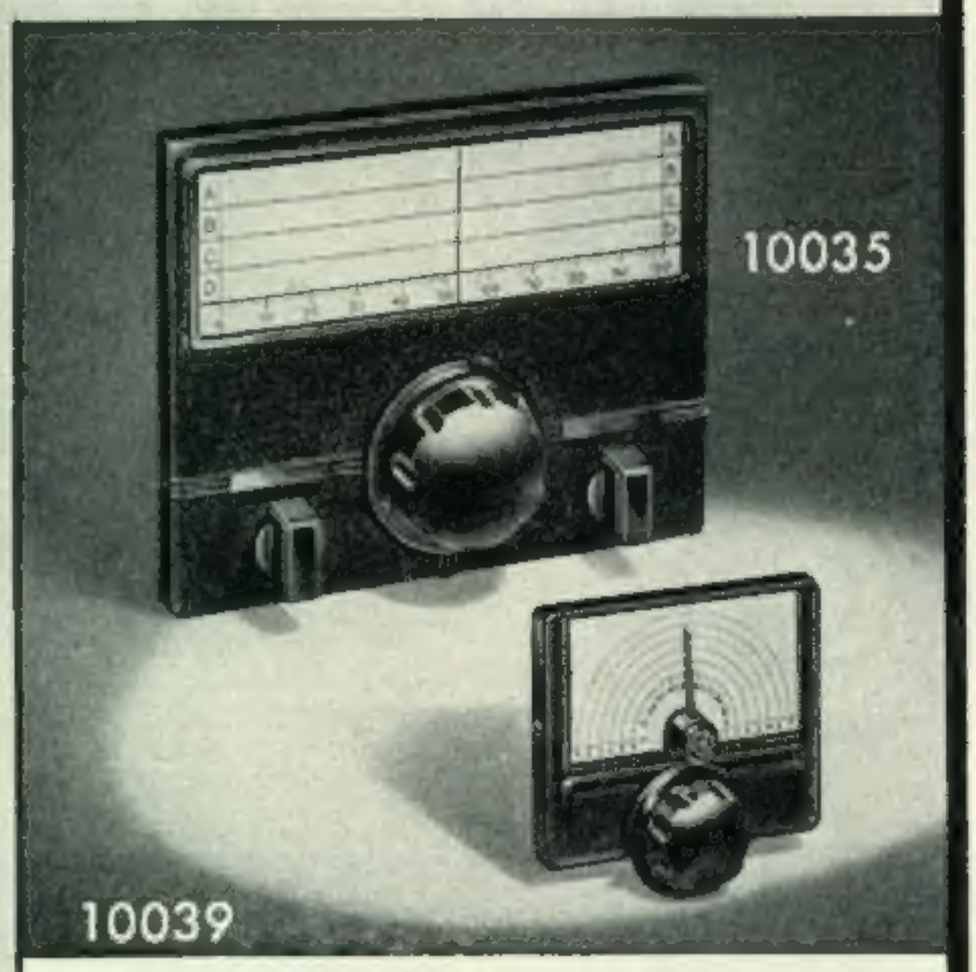
Sole Hallicrafters Representatives in Canada:
Rogers Majestic Limited, Toronto-Montreal

Designed for Application



Nos. 10035 and 10039
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A pair of truly "Designed for Application" controls. Large panel style dial has 12 to 1 ratio; size, 8½" x 6½". Small No. 10039 has 8 to 1 ratio; size, 4" x 3¼". Both are of compact mechanical design, easy to mount and have totally self-contained mechanism, thus eliminating back of panel interference. Provision for mounting and marking auxiliary controls, such as switches, potentiometers, etc., provided on the No. 10035. Standard finish, either size, flat black art metal.

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• • • Letters • • •

Current vs Electron Flow

1935 S. Austin Blvd., Cicero, Ill.

Editor, *CQ:*

Congratulations on your Amateur Newcomer articles. I think they are a swell idea, not only for the beginner but also for us old-timers as well to enable us to brush up on a lot of theory we are a little rusty on.

However, in the article on power supplies I find contradictory statements on the theory of operation. In the circuit diagram the arrows show current flow from plate to cathode on the 5U4G. This is impossible since current flows only from cathode to plate in any tube. Actually, current flow is the reverse of the arrows shown and flows through the load and bleeder resistors from the negative side of the power supply to the positive side, then through the filter chokes back to the rectifier tube. Right?

Your articles are fine; keep up the good work.

L. E. Parker, W9QVN

---

559 Stepney St., Inglewood, Calif.

Editor, *CQ*:

Over twenty years ago I tried to make a study of physics pertaining to radio, but in reading average textbooks I met with confusion so I decided to overlook a good many explanations and find my own.

Today I received the August issue of *CQ* and find that we are still in the primitive stage of education, equivalent to telling the student that the earth is round and then explaining that our ancestors' belief was correct in that the earth is flat and supported on four pillars. For on page 36 I find a circuit diagram for the Amateur Newcomer illustrating the current flow in a power supply with arrows indicating that current flows from the plate to filament. Your confession on page 8 of the same issue in "The Private Life of *CQ*" indicates that the blame rests on the *CQ* staff itself, rather than the authors.

Art Hansen

The criticism is quite correct if "electron flow" is being considered, and no clear distinction was made in the article between "electron flow" and the more commonly used term "current flow." Unfortunately, the convention adopted generally is opposite to the actual physical conditions now known to prevail. The discovery of this latter fact is a fairly recent one and science and engineering have not seen fit to change all the rules, etc., that are involved. In spite of this situation, no difficulty need arise, since the term "current flow," symbolized by "I", is assumed to occur in the direction of decreasing potential (from positive to negative). In this latter sense the wiring diagram as shown is correct.—Ed.

QSP OM?

Wheatland, Inc.

Editor, *CQ*:

I don't intend to take part in the argument between W3HH and W8RN, but the incident of the "105 NYs" described by W3HH* brings back old memories.

Being full of the old Navy spirit, I maintain that some Navy ops can make bigger and better blunders (pineapples, we called 'em) than any ham on the air.

(*Continued on page 96*)

---

*"*Letters,*" CQ, Aug, 1947, p. 6.*

GOING... NARROW BAND?

...then this is for You!

The authorization for wider use of Narrow Band Frequency Modulated phone emphasizes an important problem in frequency control. On NBFM freedom from drift is absolutely essential if you want to "stay in" the other fellow's speaker. On AM it takes considerable drift to put you out of audio range, because your whole carrier is relatively undistorted. With NBFM it's different. Your speech is intelligible on the average receiver ONLY a few hundred cycles at each edge of your carrier. If you drift a little the receiver goes into the "mush" at the center of your carrier or out of your carrier entirely. If you're going Narrow Band use PR Precision CRYSTALS. They're truly low drift . . . less than 2 cycles per MC per degree Centigrade. Many AM stations avoid working FM stations because of the drift problem. PRs will make you popular with your QSOs. — Petersen Radio Company, Inc., 2800 W. Broadway, Council Bluffs, Iowa. (Telephone 2760)

SINCE 1934

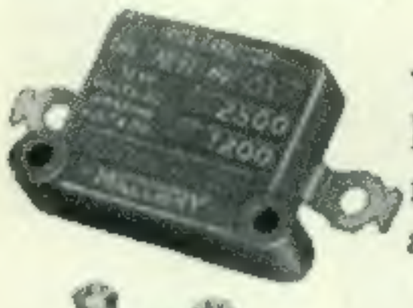
PR Precision CRYSTALS

10 METERS PR Type Z-5.	Harmonic oscillator. Ideal for "straight through" mobile operation. High activity. Heavy drive without damage in our special circuit $5.00
20 METERS PR Type Z-3.	Harmonic oscillator. Low drift. High activity. Can be keyed in most circuits. High power output. Just as stable as fundamental oscillators $3.75
40 & 80 METERS PR Type Z-2.	Rugged, low drift fundamental oscillators. High activity and power output with maximum crystal currents. Accurate calibration. $2.75

WHEN YOU NEED A TRANSMITTING CAPACITOR

CHOOSE MALLORY FOR DEPENDABILITY

Quality and reliability are traditional with Mallory. In no products are they better illustrated than in Mallory transmitting capacitors. Mallory knows the penalty of failure—time off the air, possible damage to associated components. Mallory gives extra protection against these contingencies—offers you also a well rounded line:



TYPE MH Moulded Bakelite, Mica Dielectric. 18 values from .0001 mfd to .02 mfd in working voltages from 600 to 2,500.

TYPE MX Porcelain Cased, Mica Dielectric. 7 values from .001 to .1 mfd in working voltages from 2,000 to 12,500.

TYPE TZ Round Can Type, Paper Dielectric. 10 types, in working voltages from 600 to 2,000.

TYPE TX Rectangular Can Type, Paper Dielectric. Broadcasting station quality, but priced so that the amateur can afford them. 36 types, capacitors 1/10 to 10 mfd in working voltages from 600 to 6,000.

Information on the complete line of Mallory Transmitting Capacitors will be found in the Mallory Approved Precision Products Catalog.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS 6 INDIANA

P.R. MALLORY & CO., Inc.
MALLORY

Feenix, Ariz.

Dear Hon. Ed. Sir:

Boy-oh-boy have I been having the fun recently! I are finding that I still have plenty of monies around (an unusual situayshun for Scratchi) so I are deciding to spend it on amatchoor radio. With this in mind one day, I are retiring to peece and quiet of my shack, loaded down with old copies of your hon. rag, and other radio mags. After getting a jug of cactus juice I get cumfortably settled and refreshed and I start to thumb through said mags, all with an eye open to see what is appeeling on which to squander my monies.

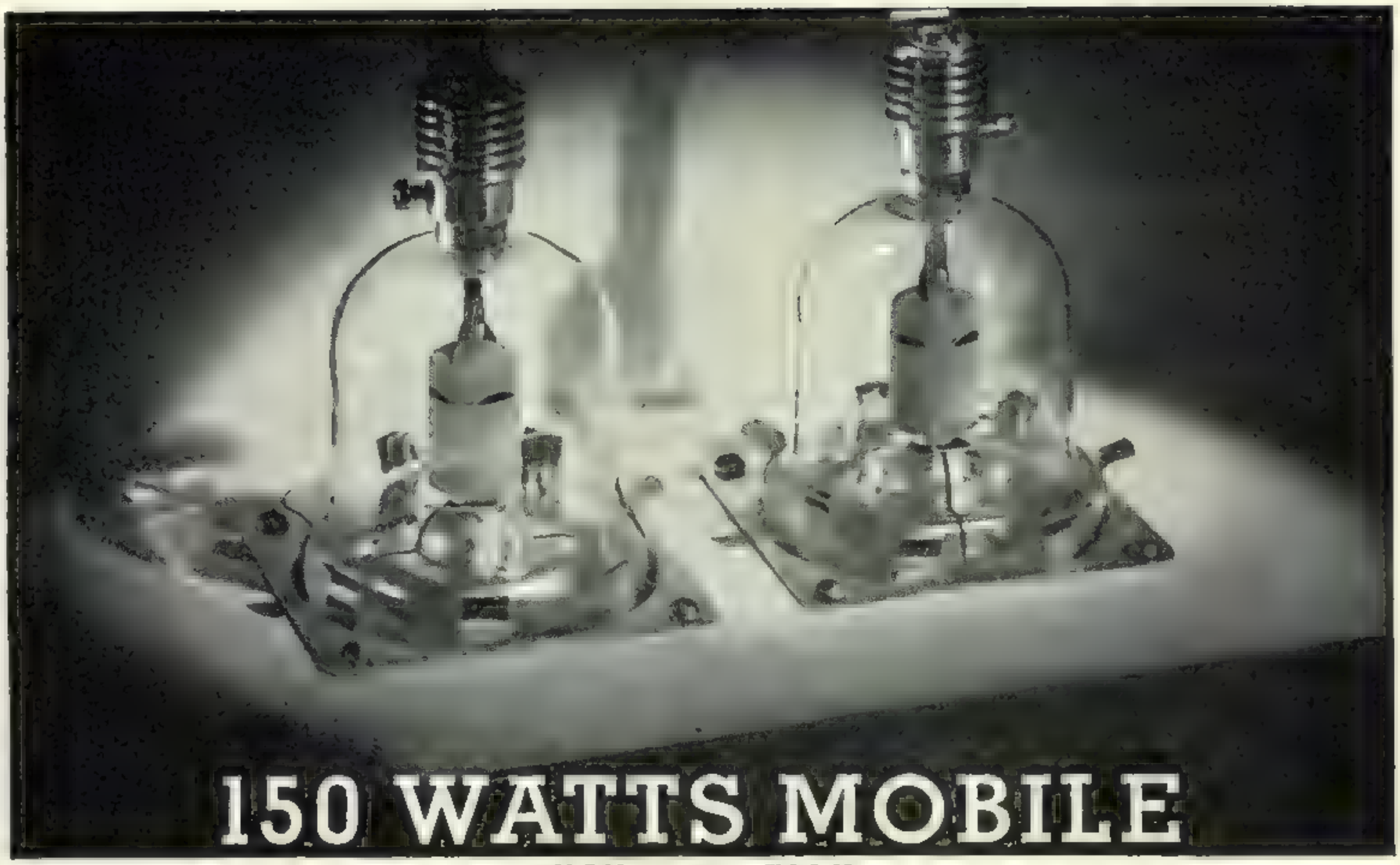
I are having just bilt a sooper-modern station, so I am on outlooks for mainly axesessories for using around shack. One phoney monitor are attratking my attenshun but I are soon discarding idea as not being elaborate enough for Scratchi's tonsil exersizing. Another place are describing reel slick noisy silencer but I are not believing it help me, as my brother Itchi's ranch are reel quiet. Only automobiles around here besides Itchi's are those which are lost.

One more jug and several dozen mags later I are finding the fine print rather wobbly, so I are making mental note either to install more lights in shack or see eye doctor. The more and more ads I are reeding the more interesting I am getting. Hon. Ed, it are amazing what sooper bargains are in the ads. They are calling most of it surplus equipment. This are most confusing. If they are having it available to sell, it must be surplus, whereas if they are not having it available to sell, no point in advertising is there? And such fancy numbers they are giving the equipments. I quote—"Surplus Transmitter RS-1907/GGL70921. Who could not be helped to be attratked to such lovely numbers?

One item are really sounding hots stuff. It are described as coming in genuwine aluminum box, with black, crackly paint, and are having sockets for 16 tubes, four variable condensers, six different kinds mica condensers, and are complete with shock mounts, but less tubes, all for $1.75. I can not finding what are supposed to be useful for, but this are undoubtedly oversight on acct. the ad prepared in such a hurry to advertise such stewpendous bargain. I are nor reel excited, so I keep reeding ads and finally I are unable to resist such bargains. I rush out and wake up brother Itchi (he taking siesta under my 20 meter beam) and convince him that we should take a trip over to Los Angeles and surrounding territories and cleen out sum of the radio stores from these hot buys. Itchi are easily talked into same, as he are needing sum supplies for the ranch anyhow.

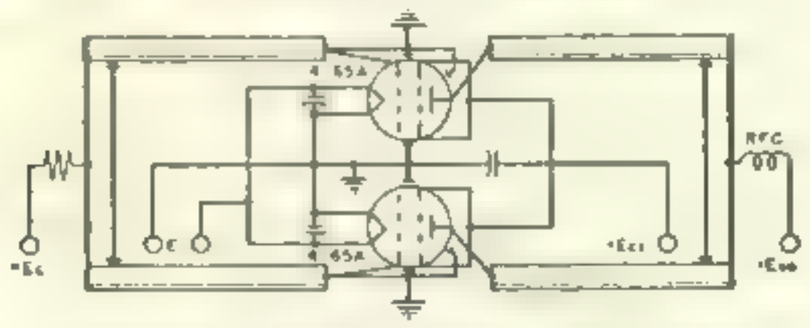
The trip over and back are reel successful, and Itchi and I are reely spending the bux. Yes, even Itchi are getting the speerit when he sees what are

(Continued on page 90)



PUSH TO TALK

With the announcement of the new Eimac Tetrode type 4-65A, satisfactory high-power mobile transmission became a reality. Designed as a transmitting tube, with the transmitter man's problems in mind, the 4-65A provides stable operation over a voltage range of from 400 to 3000 volts. This characteristic alone enables continuity of system design, using the same vacuum tubes in the final stage of both the mobile and fixed station (two 4-65As will handle 150 watts input with 600 plate volts in the mobile unit, and operating at 3000 plate volts, in the fixed station, two 4-65As provide ½ kilowatt output).



SIMPLIFIED CIRCUIT FOR USE ABOVE 100-MC.

The tube is a "natural" for the 152-162 Mc. band. Its low interelectrode capacitances, compact structure, short electron transit time, high transconductance, together with being a tetrode allows simplification of circuit. Operation of the 4-65A can be continued up thru the 225-Mc. amateur band in either FM or AM service.

The 4-65A incorporates an instant heating thoriated tungsten filament, processed grids—controlling primary and secondary emission, and a processed metal plate—enabling momentary overloads without affecting tube life. All of the internal elements are self supporting without the inclusion of insulating hardware. Neutralization is normally unnecessary since practical isolation of the input and output circuits is achieved by the screen grid and its supporting cone. No special gear is required for installation, as the five pin base fits available commercial sockets.

In typical operation, class-C-telegraphy or FM-telephony, one 4-65A with a plate voltage of 600 volts, 125 milliamperes of plate current, and a plate power input of 75 watts will provide 50 watts of output with less than 2 watts of grid drive. In 1500 volt operation with an input of 190 watts, the output is 140 watts. With the plate voltage increased to 3000 volts and an input of 325 watts, an output of 265 watts per tube is obtained.

The 4-65A is amazingly versatile, being ideally suited for audio, television, r-f heating, and communication applications, stationary or mobile. It is priced at $14.50 each. Additional data may be had by writing to:

EITEL-McCULLOUGH, Inc.
181 San Mateo Ave., San Bruno, California

Follow the Leaders to

Eimac TUBES *The Power for R-F*

Export Agents: Frazar & Hansen, 301 Clay Street, San Francisco, 11, California

To insure performance of the 4-65A . . . severe mechanical tests are conducted—from withstanding a bump test to holding up under excessive vibration. Tests are carried even further . . . satisfactory shipment of the tube is insured by package drop tests.

THORDARSON

Presenting . . . . .

THE NEW THORDARSON LINE OF SPLATTER SUPPRESSOR CHOKES!

Here at last is the new line of Thordarson Splatter Suppressor Chokes you have been waiting for! Engineered and manufactured by Thordarson for amateur use, these quality units make narrow channel AM transmission with minimum band-widths a reality. Designed to permit a higher percentage of modulation, these components considerably increase the get-through ability of the signal.

These new chokes have 10,000 volt insulation, variable inductive range from .2 to 1.5 henries, low distributed capacity, good "Q" and chatter-proof construction. Harmonic distortion is minimized and broadcast interference sharply reduced. No critical adjustments are required.

For complete specifications write today to the address below:

Thordarson

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GET SYLVANIA QUALITY in TRANSMITTING Tubes too!

INVESTIGATE THE TYPE 3D24

BEAM POWER TETRODE WITH ELECTRONIC GRAPHITE ANODE

First of Sylvania's new line of transmitting tubes, the 3D24 is a four-electrode amplifier and oscillator with 45 watt anode dissipation. An outstanding development is the electronic graphite anode, which allows high plate dissipation for small area and maintains constant interelectrode relationship and uniform anode characteristics.

The 3D24 may be used at full input up to 125 Mc—maximum permissible frequency will be announced later upon completion of tests.

OTHER FEATURES INCLUDE:

1. **Top cap** providing for short path, greater cooling by radiation and convection, resulting in a cooler seal.
2. **Thoriated tungsten filament,** giving high power output per watt of filament power.
3. **Vertical bar grids.** #1 grid supplied with two leads for better high frequency performance. #2 grid provided with heat-reflecting shield for greater dissipation, low grid-plate capacity.
4. **Low interelectrode capacity.** No neutralizing needed with proper circuit arrangement.
5. **Hard glass envelope.** Permits high power for small size.
6. **Lock-In base.** Short leads, no welded or soldered joints.

The 3D24, a product of the Electronics Division of Sylvania Electric, has interesting potentialities in amateur, police, mobile and marine radio.

MECHANICAL SPECIFICATIONS

Type of cooling	Air—radiation and convection
Mounting position	Vertical, base down or up
Length overall	4.3 inches max.
Seated height	3.769 inches
Diameter	1½ inches
Net weight	1.3 ounces

ELECTRICAL CHARACTERISTICS

Filament Voltage	6.3 volts
Filament Current	3.0 amperes
Amplification Factor	50
Direct Interelectrode Capacitances	
Grid-Plate	0.2 $\mu\mu$f max.
Input	6.5 $\mu\mu$f
Output	2.4 $\mu\mu$f
Maximum Class "C" Power Input	180 watts C.C.S.

Direct inquiries to Radio Tube Division, Emporium, Pa.

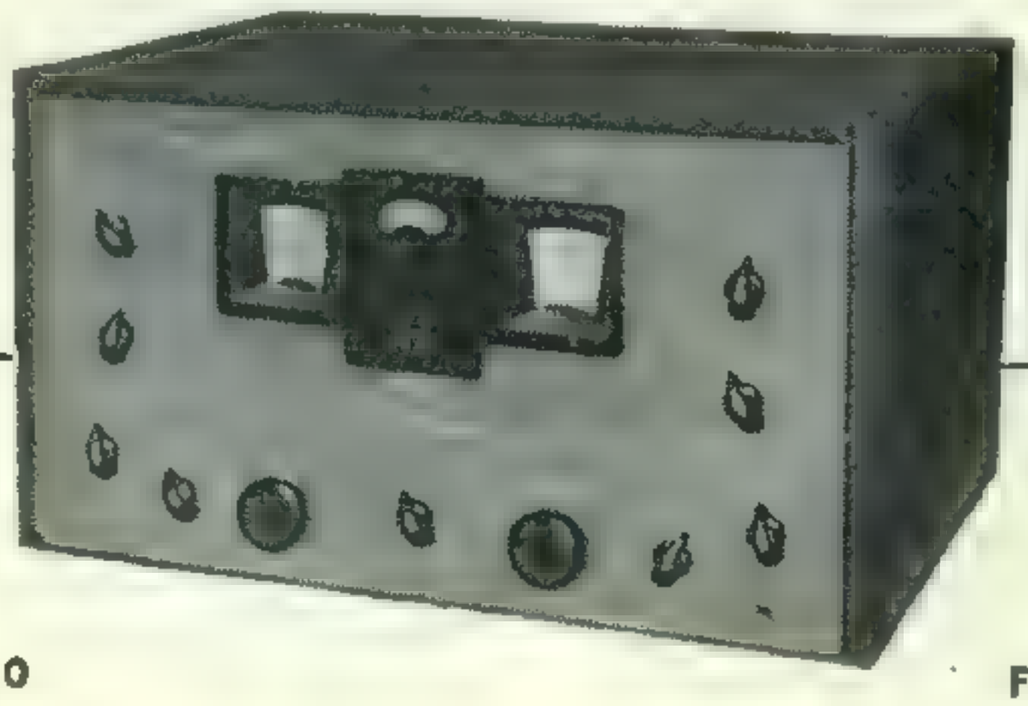
SYLVANIA ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

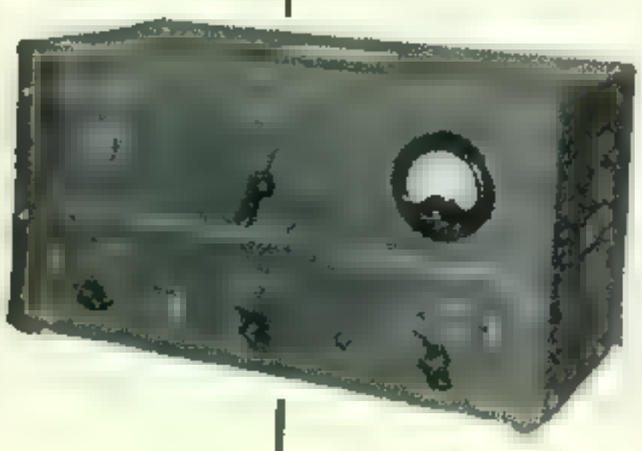
HQ-129-X

Up to the minute

Full range .54 to 31 mc in six accurately calibrated bands • Band spread with four calibrated ham bands and all-purpose scale • Variable selectivity crystal filter for phone or cw. • Antenna compensator for maximum image rejection and high sensitivity • Voltage regulation. Noise limiter that really kills noise • Adjustable S meter • *Three* IF stages . . . The HQ-129-X has every up-to-the-minute improvement that radio science has so far developed for amateur radio receivers.

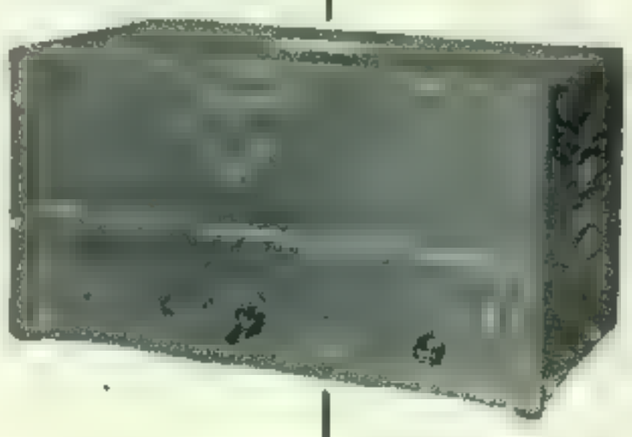


FOUR • 20
TRANSMITTER



The Four-20 makes an efficient exciter for any final amplifier from a hundred watts up to a tetrode kilowatt. The Four-11 will drive a high power modulator. Why not build the big rig yourself? Use the Four-20 to drive the final and the Four-11 to push the modulator.

FOUR • 11
MODULATOR



WRITE FOR TECHNICAL BOOKLET

HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.
MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

ZERO BIAS

EDITORIAL

Life Insurance in the Shack!

STARTING on page 32, appears an article prepared by Dr. G. J. Nichols, W3JAY, which we think is one of the most important contributions to amateur literature in many years. The article deals with all the ramifications of electric shock and the emergency treatment for it. We feel the first aid aspects are so urgent that we have printed a special page specifying the procedure for emergency treatment for electric shock. This special page is so made that it may be removed from *CQ* and posted in a prominent place in your station.

Some newcomers who read the article may be appalled by the possible sources of danger in amateur radio . . . some old-timers are likely to wonder why they are still alive. The article is not meant to arouse such extreme emotions. Amateur radio is a remarkably safe hobby and the few tragic electrocutions that have occurred over a period of years might be expected in a hobby enjoying such wide participation. But even these accidents that ended in death, in all but a few cases might have been prevented by anyone possessing the knowledge presented in this article.

To help prevent future accidents, to awaken the average ham to the importance of obeying fundamental rules of safety, "Life Insurance in the Shack!" should be required reading for all amateurs. The emergency treatment for electric shock should be required reading for every member of his household.

Amateur Frequencies

The seriousness of the amateur position in regard to the frequency allocations in Atlantic City is not to be minimized as the conference draws to a close. While it is very true that American hams lost only 50 kc of 20 and gained in their place a 450-kc band at 21 mc, the pattern of sharing, the violent attacks on our frequencies, the pessimistic attitude of amateur representatives . . . all these things are a grim portend of the next conference. There will be a next conference and another and then another. If amateur radio is to survive as a hobby we must recognize that these threats will increase in magnitude every year. The violent anti-amateur position taken by a few powers representing a fraction of the world's hams was almost sufficient to nulify all the assistance the amateurs got from their supporters. While hindsight is always superior to foresight, in retrospect one can hardly feel that the full political force of a highly organized minority group such as the amateurs could constitute was utilized to our maximum benefit before the conference. Whatever the reason, the damage is done, and we must start to prepare for the next conference now, not waiting until the ugly pattern of "sharing" gradually absorbs large portions of our remaining bands. You can expect to read much more about frequencies in these editorials in the months to come. We aim to fight for what is rightfully ours—no one has done us a favor by permitting us the use of our own frequencies and the sooner we realize it the better off we'll be in any attempt to keep the American ham bands 100% amateur.

Threshold Diplomacy and TVI

THE SERIOUSNESS of television interference is rapidly growing and in cities already serviced by TV stations conditions are becoming nothing short of desperate. As the service areas of stations are extended and as new stations are installed, the problem will spread so it is definitely the concern of the majority of hams.

In the dozens of TVI cases we have investigated personally we saw only one or two isolated instances where the interference was completely eliminated. Of course, it was our experience to encounter complaints where the amateur was causing less trouble than automobile ignition, diathermy, etc., or where the TV installation was entirely at fault, but determining the party at fault did not lessen the interference or inconvenience one iota.

The situation boils down to this. While many amateur stations are not meeting all the requirements of the F.C.C. insofar as the best engineering practices that must be observed, the majority of hams do meet these requirements. Attenuation of the fourth harmonic of some 20-meter stations we visited was in the order of 50 db, yet they caused TVI. The answer is, obviously, not very simple. The television stations themselves have very weak signals compared to standard broadcast stations in any given service area. One particular neighborhood, the home of hundreds of TV sets, showed an average field strength for television stations of about 1000 μv. This compares to 10,000 μv for a broadcast station operating with the same carrier power and without the benefit of high-gain antennas.

It is estimated that a ratio of 100-to-1 is sufficient to cause interference on the video channel—thus a fourth harmonic of 10 μv could cause trouble in a TV set. To achieve a harmonic this small is just about impossible from a high-power transmitter, in light of present-day knowledge. More power in the television stations to increase their field strength and improve the ratio of interfering signal to received signal will help tremendously. But it is beyond the power of the ham to do anything about this lack of signal strength. Television people are well aware of this particular problem and are working to do something about it, but until very high power can be run on TV frequencies, the tubes for which

(*Continued on page 88*)

COLLINS REINSTATES DIRECT SELLING

Prior to the appearance of this announcement, sales of Collins amateur equipment have been made solely through designated dealers. However, continued sharply increasing costs of materials, components and manufacturing have rendered this method of distribution impracticable.

The function and value of the amateur radio dealer are universally understood and appreciated. He invests in ham equipment, displays it, lists it in his catalogs, and puts time into selling and servicing it. But if his well-earned, normal profit is added to the present necessary factory price of Collins equipment, the resulting price to the amateur becomes prohibitive.

Therefore, since the Collins Radio Company has pledged itself to offer the amateur the best equipment that can be built, incorporating innovations which give superior performance, we now announce a return to our pre-war policy under which you may purchase any of our amateur equipment direct from the factory. The following prices will prevail, net F.O.B. Cedar Rapids, Iowa:

30K-1—500 watt Transmitter, complete with 310A Exciter, Tubes, Microphone Cord, R. F. Cable, Power Cable and Instruction Book.....**$1450.00**

32V-1—150 watt Transmitter, complete with Tubes and Instruction Book.....**$475.00**

75A-1 Receiver, complete with Tubes, Speaker and Cabinet assembly, and Instruction Book (including excise tax).....**$375.00**

70E-8 Variable Frequency Oscillator, complete with Tube, 305H-1 Dial Assembly and Instruction Book.....**$40.00**

310B-1 Bandswitching Exciter, complete with Power Supply, Tubes and Instruction Book.....**$190.00**

310C-1—80 meter Exciter, complete with Tubes and Instruction Book, less Power Supply.....**$85.00**

310C-2—80 meter Exciter, complete with Power Supply, Tubes and Instruction Book.....**$100.00**

You may purchase any of our amateur equipment with the exception of the 70E-8 Oscillator for 20% down. The unpaid balance, plus 5% interest is to be paid in twelve equal monthly installments. The procedure is simple: Remit 20% with your order; we will send you a credit application which will be subject to prompt action when you mail it in.

All orders will be shipped in the sequence received, and usually within two weeks of receipt of order, except the 32V-1 (December 15, 1947) and 310B-1 (February 1, 1948). You can now have the benefits of superior Collins performance at a competitive price, and pay out of income on favorable terms. Early action is suggested.

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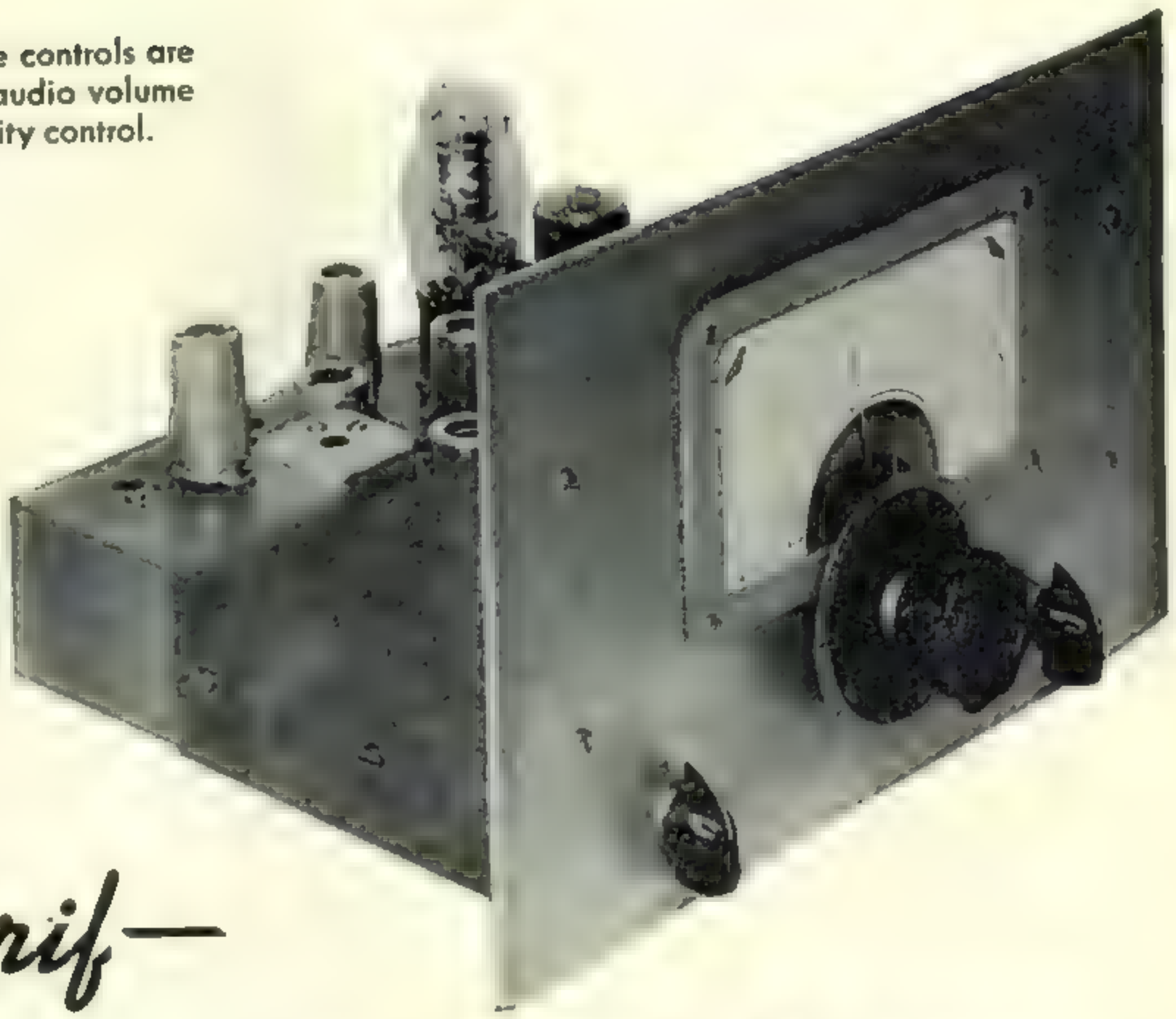


Front panel of the Varif. The three controls are the main tuning vernier dial, the audio volume control and the bandwidth selectivity control.

The Varif— A New Receiver for 2 Meters

An acorn tube superhet featuring a variable bandwidth i.f.

L. P. NEAL, W1OQK*

and

HERB B. WELLS, W1WS**

THERE HAVE BEEN SEVERAL different types of 2-meter receivers and converters placed on the ham market in the last several years. For a large part these units have lacked the refinements desired by the authors. In brief, these features require that a 144-mc receiver must have good sensitivity, should be a superhet, must have a noise limiter and should have provisions for enabling the operator to copy either crystal-controlled signals or modulated oscillators.

Of the four prerequisites, the latter one appears to be the most difficult to install in our present receivers. The obvious solution to reading the signal of the modulated oscillator is increasing the i-f stage bandwidth to such a point that it passes a very large proportion of the sidebands. However, almost any receiver will suffer a tremendous loss in i-f gain if the bandwidth were stretched beyond 100 or 150 kc. On the other hand, the average maximum bandwidth required at 144 mc is about 400-500 kc. The question is, therefore, how to obtain constant uniform gain in a receiver that will incorporate continuously variable bandwidth.

The Circuit

The design of a receiver having all four features has led to the development of the "2-meter variable bandwidth i-f system receiver," or for purposes of simplicity, the *Varif*. In outward appearance and with the exception of a few added components, this receiver is no more complicated than any conventional superhet for the v.h.f.

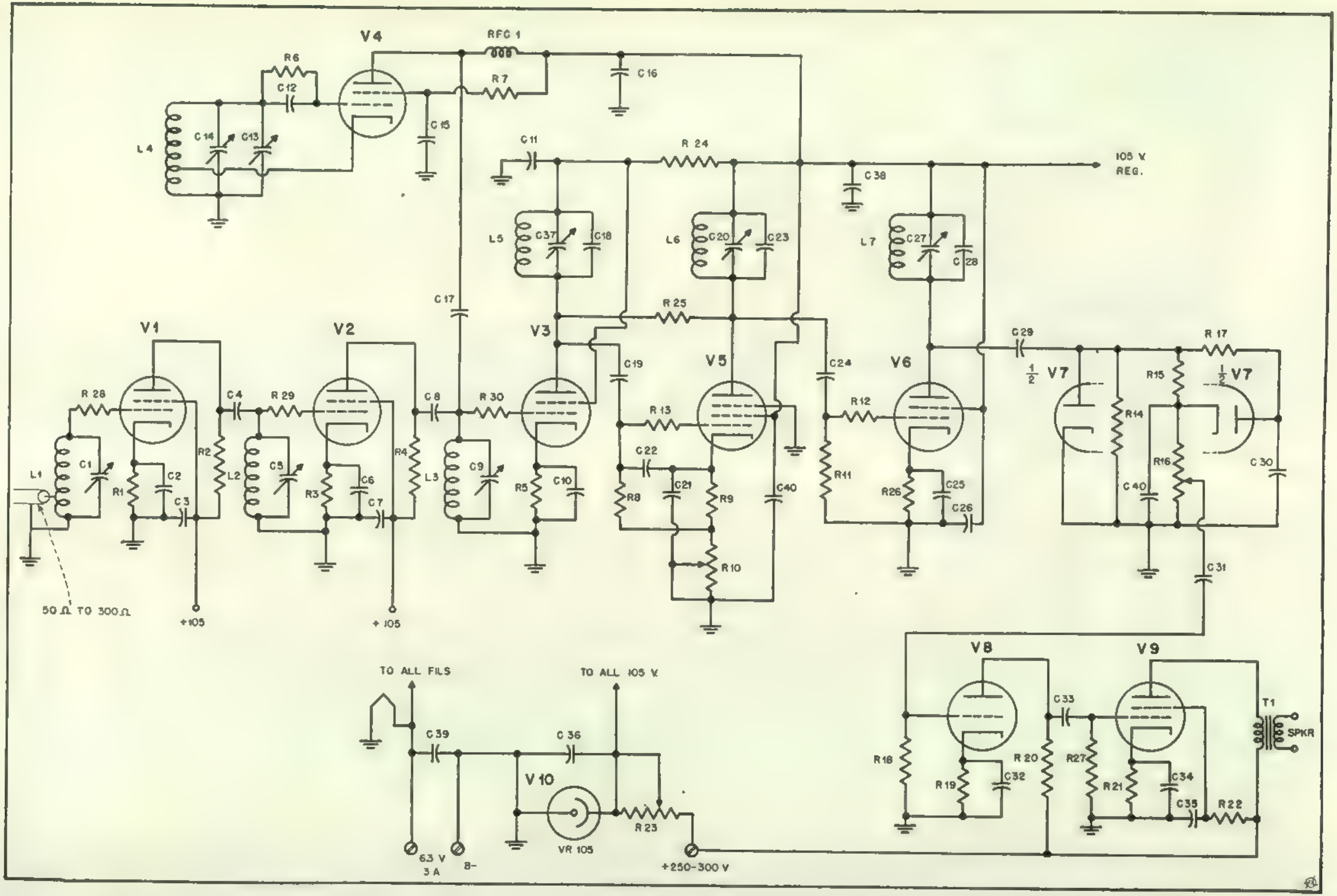
The complete schematic of the receiver is shown in *Fig. 1*. Two broad-band r-f stages using 6AK5 tubes are placed ahead of the mixer stage. Although a 50-ohm antenna input impedance is shown in *Fig. 1*, it is possible to use anything from *50 to 300 ohms* with only a very slight change in the noise factor of the first r-f stage. The oscillator (*V4*) and the mixer tubes (*V3*) are also 6AK5s. Following the mixer stage is the variable bandwidth i-f stage which employs a 6AS6 (*V5*). The second i-f stage (*V6*) is relatively broad-band, the output of which is fed into the second detector and noise limiter (*V7*). Two audio stages (*V8* and *V9*) complete the receiver, except for the external power supply and the voltage regulator (*V10*).

The high gain and low interelectrode capacities of the 6AK5 have done much to simplify the construction of the Varif. Because the mixer grid circuit is also broad-band all tracking problems are removed and only the oscillator tank coil is tuned. The two r-f stages provide a gain of about 30 db over a bandwidth of approximately seven megacycles. It is possible to increase the gain of these two stages to about 40 db through the use of larger plate load resistors, but this has not been found necessary in the several models of the Varif constructed by the writers. The r-f stage band-pass response curve may be seen in *Fig. 2*.

10-ohm resistors (*R28*, *R29* and *R30*) are inserted in the control grid leads of the r-f stages to discourage any tendency toward 280-mc parasitics.

**W1OQK*: *35 Edison Green, Dorchester 25, Mass.*

***W1WS*: *397 N. Main St., Natick, Mass.*


V4
RFC 1
R6
C12
R7
C16
C14
C13
L4
C15
C11
R 24
105 V REG.
C38
L5
C37
C18
L6
C20
C23
L7
C27
C28
C17
R 25
V1
V2
V3
V5
V6
C29
R 17
½ V7
½ V7
C19
C24
R 28
C4
R 29
C8
R 30
R 13
R12
R15
R14
C1
R2
C5
R4
C9
C22
R16
C30
L1
C2
C6
L2
L3
C21
R11
R26
C25
C26
R1
C3
R3
C7
R5
C10
R8
R9
C40
C40
R10
C31
50 Ω TO 300 Ω
+105
+105
V8
V9
TO ALL FILS
TO ALL 105 V
C33
T1
SPKR
C39
C36
R18
R20
R27
V 10
R19
C32
R21
C34
C35
R22
R23
VR 105
63 V 3 A
B-
+250-300 V

The effect of the series resistance on absolute sensitivity is very small, amounting to something less than one part in 540 for each stage, or less than 0.17 db for the three stages and three resistors. The slight hump in the band-pass curve at 147.75 mc is due to the capacity across the ends of these resistors which is in series with the cathode lead inductance.

The i-f frequency is approximately 10 mc. Low beat with the oscillator working between 133 to 139 mc is used. This will spread the 2-meter band over two-thirds of a 180-degree dial. All coils are homemade and the i-f coils must be placed inside shield cans.

The Variable Bandwidth Stage

The theory behind the operation of the variable bandwidth i-f stage may be visualized by examining the necessary steps in its development. *Fig. 3* shows the 6AS6 i-f stage as it appears in this circuit stripped of all non-essentials for the purpose of discussion. The 6AS6 has separate cathode and suppressor pin connections and when operated as a Class A amplifier has a *gm* of about 3500 μmhos. The nominal voltage gain for a pentode stage (neglecting the effects of *R2* in *Fig. 3*) is

$$A_v = gm\ Z_0 \text{ or } 0.0035 \times 7500 = 26$$

Thus, if a one-volt signal is applied to the grid of the 6AS6, there will be a deflection of the plate voltage of about 26 volts. If the grid voltage change was increasingly positive the plate voltage swing would be downward or, in other words, we now have in *Fig. 3* a potential difference of 27 volts existing across *R2*. If we make *R2* equal to 27,000 ohms there will be a flow of current according to Ohm's Law equal to voltage divided by the resistance, or 1.0 ma. If this current passes through *R2* it must also flow in the grid circuit and again by using Ohm's Law we can find the *effective* grid input resistance would be equal to the input signal voltage divided by the current, or

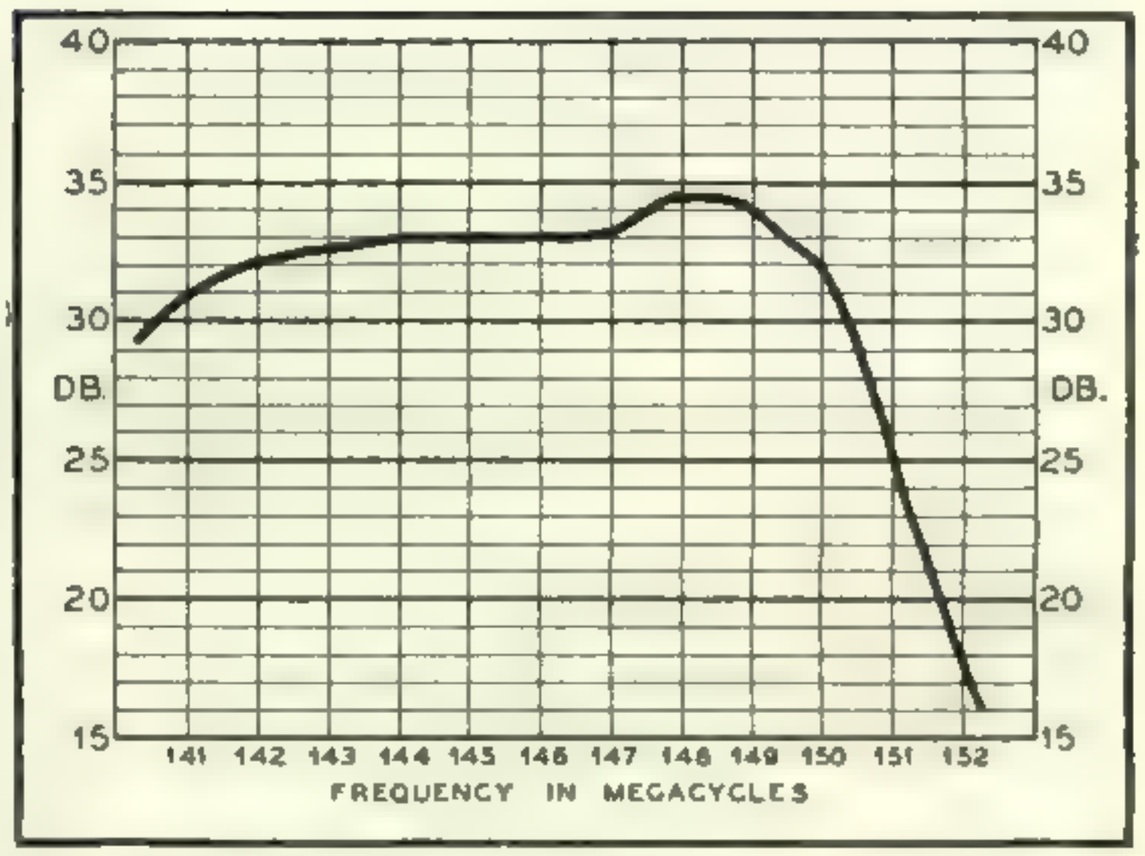


Fig. 2. Front end characteristic of varif with 10-ohm series grid resistors (signal input at antenna in μv).

1000 ohms. This is only the effective grid resistance since the flow of grid current in this stage will alter many otherwise normal factors.

If we provide a means in the 6AS6 i-f stage of varying the gm of the tube (cathode potentiometer *R10* in *Fig. 1*) we will be able to vary the voltage gain of the stage. If the gm is reduced to 1750 we find on repeating the process outlined above that the nominal voltage gain would be 13, making the potential difference across *R2* now 14 volts. Since *R2* remains at 27,000 ohms, the current flow would then be only 0.5 ma and with a one-volt input signal the effective grid resistance is now doubled, or 2000 ohms. Therefore, a variation in the gm of the 6AS6 i-f stage has resulted in an inverse variation of the effective grid resistance.

The next step in the development of the Varif is shown in *Fig. 4*. The circuit *L1 C1* is of a low Q and wide bandwidth due to the loading effect of *R1*. The loading of a tuned circuit in this fashion is

Fig. 1. Complete schematic of the Varif 2-meter receiver. The first i-f stage employs a feedback system to the mixer stage providing constant gain and a variable bandwidth of from 40 to 500 kc.

C1, C5, C9, C14—3-13 μμf ceramic trimmer, Erie N300.
C2, C3, C6, C7—470 μμf mica.
C4—40 μμf (Erie ceramicon N9505).
C8—40 μμf (Erie ceramicon N750K).
C10, C11, C25, C26, C38, C40—4700 μμf mica.
C12—20 μμf (Erie ceramicon CC21TK).
C13—3-7 μμf variable condenser. See text.
C15, C16, C29—50 μμf mica.
C17—5 μμf ceramic (Erie NPOK).
C18, C23, C28—60 μμf mica.
C19, C24—100 μμf mica.
C20, C27, C37—7-45 μμf ceramic trimmer (Erie N650).
C21—430 μμf mica. See text.
C22—25 μμf silver mica 5% tolerance.
C30—.1 μf tubular.
C31, C33, C36, C39—.01 μf mica.
C32, C34—25 μf, 50-volt tubular electrolytic.
C35—.1 μf paper, 600-volt, tubular.
All condensers 500 volts unless otherwise specified.
R1, R3, R26—180 ohms.
R2—2.2 K.
R4—3 K.
R5—330 ohms.
R6, R11, R14—20 K.
R7—15 K.
R8, R18, R27—470 K.
R9—220 ohms.
R10—1 K pot.
R12, R13—50 ohms.
R15—250 K.
R16—500 K pot.
R17—500 K.
R19—3 K, 1 watt.
R20—300 K.
R21—500 ohms, 1 watt.
R22—5 K, 1 watt.
R23—3 K, 25 watts.
R24—1 K.
R25—27 K special Globar resistor.
R28, R29, R30—10 ohms.
All resistors are ½ watt unless other specified.
K equals 1000 ohms.
L1, L2, L3, L4—4 turns ¼" ID No. 18 enameled wire, length 5/8".
L5, L6, L7—38 turns No. 30 enameled wire, close wound on 3/16" form. See text.
RFC1—19" No. 29 wound on ¼" form.
T1—Output transformer, 5K primary to VC.
V1, V2, V3, V4, V6—6AK5.
V5—6AS6.
V7—6AL5.
V8—6SL7.
V9—6V6.
V10—VR105.
1 chassis, 8 x 9 x 2 inches.
1 panel 7 x 11 inches.
Sockets and tube shields.

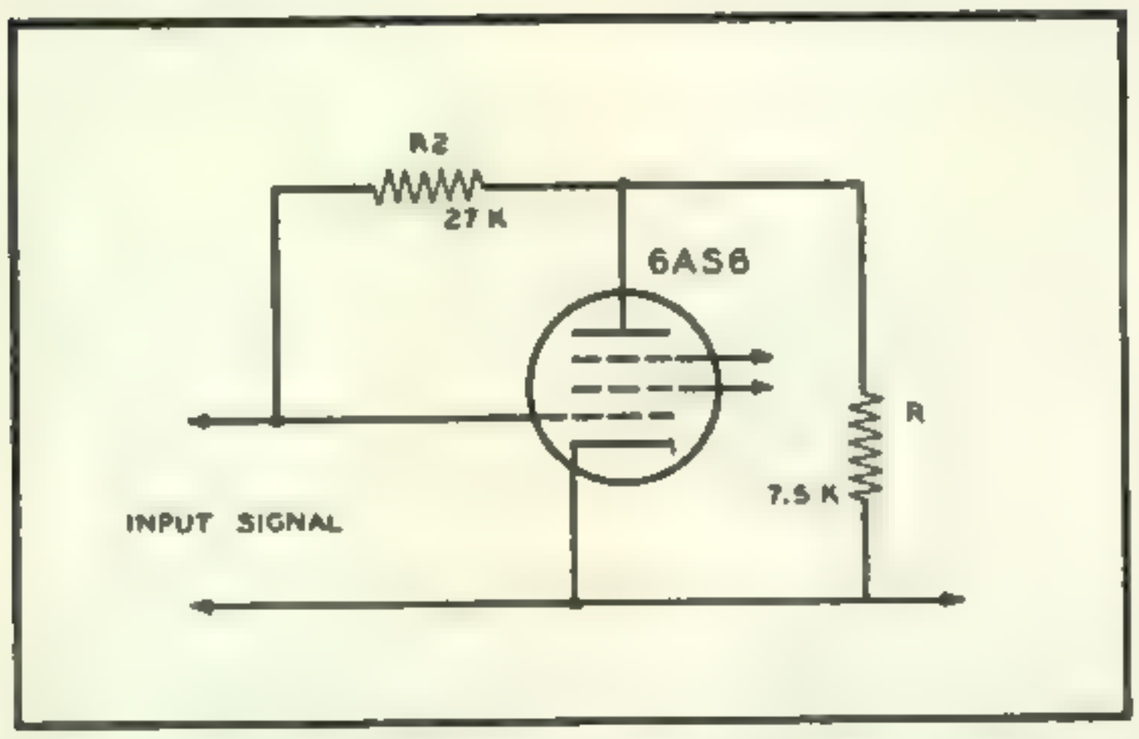


Fig. 3. The first i-f stage of the Varif may be reduced to the above circuit to obtain the effective grid input resistance.

rather common in v-h-f practices, especially in video amplifiers. At the same time we can also see that *L2 C2* is loaded with the effective grid input resistance of the 6AS6 as described above. If we vary the load on either of these tuned circuits we will change the Q and hence the bandwidth that either circuit will pass. This is exactly what we do in the case of tuned circuit *L2 C2* since if we vary the gm of the 6AS6 we will also vary the effective grid resistance. Thus, a control of the gm will give us a method of controlling the bandwidth of this i-f stage.

A means of controlling the bandwidth is of little value unless we can keep the i-f stage gain fairly constant. In the simplified circuit, *Fig. 4*, and by virtue of the coupling condenser, *C19* in *Fig. 1*, it may be seen that the plate of the 6AK5 mixer stage is looking into this effective value in such a fashion that *L2 C2* also constitutes the plate load of the mixer. Since in a pentode stage the voltage gain is approximately equal to the load impedance times the gm, any variation in the effective value across *L2 C2* will be reflected as a variation in the gain of the 6AK5 mixer stage.

The operation of the variable bandwidth i-f stage is now obvious. By varying the gm of the 6AS6 there is a change in the effective resistance across the tuned circuit *L2 C2*. When the bandwidth is reduced in the i-f stage there is also a decrease in the voltage gain in that stage. However, since the tuned circuit

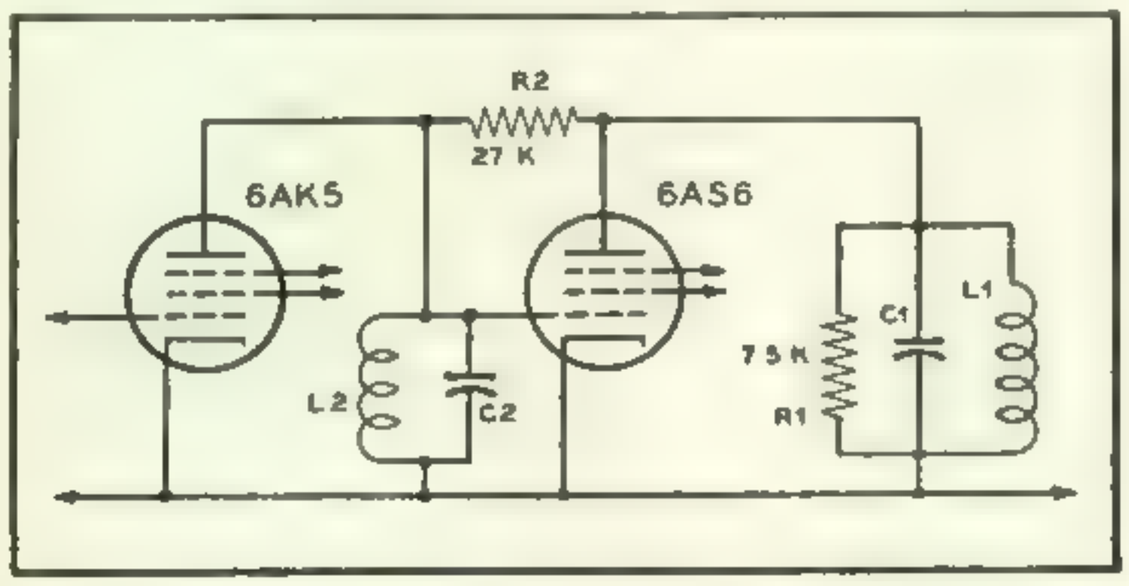


Fig. 4. In the receiver circuit the variable i-f stage apperas in this fashion. Note that one tuned circuit is used as the plate load of the 6AK5 and as the grid tank of the 6AS6. By varying the gm of the 6AS6 there is a changing flow of current through the feedback resistor. This varies the effective value of the shunting network across this tuned circuit and hence changes the bandwidth while at the same time the gain remains constant.

also appears as the plate load of the mixer stage any increase in the effective resistance value results in a compensating gain in the 6AK5. Although the gm of the two tubes is not identical, it has been found that the proper selection of component values and the operation of the 6AK5 as a mixer results in a uniform i-f gain from 50 to 500 kc.

It can be shown experimentally that for optimum results (conditions of absolute constant gain and maximum circuit narrowing) the tuned circuit *L2 C2* should be paralleled with a negative resistance equal to the 27,000-ohm *feedback* resistor. The method of accomplishing this is shown in *Fig. 5*. Here the circuit ignores the d-c components but has the signal components under consideration. If *C2* is not of a large capacity there will be some cathode voltage developed as the grid is driven. This voltage is applied to the cathode side of *C1*, which effectively makes *C1* have a negative resistance component. By carefully choosing the proper values of *C1* and *C2*, a negative resistance will be developed which will be just great enough to equal the value of the feedback resistor.

To maintain the value of negative resistance constant the cathode current must also remain constant.

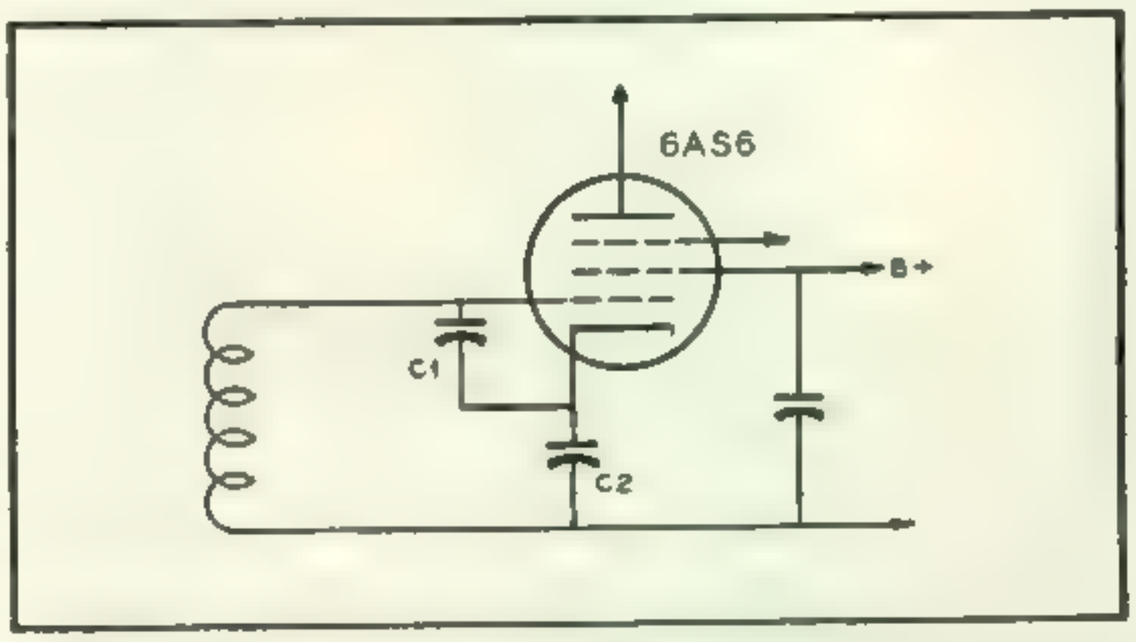
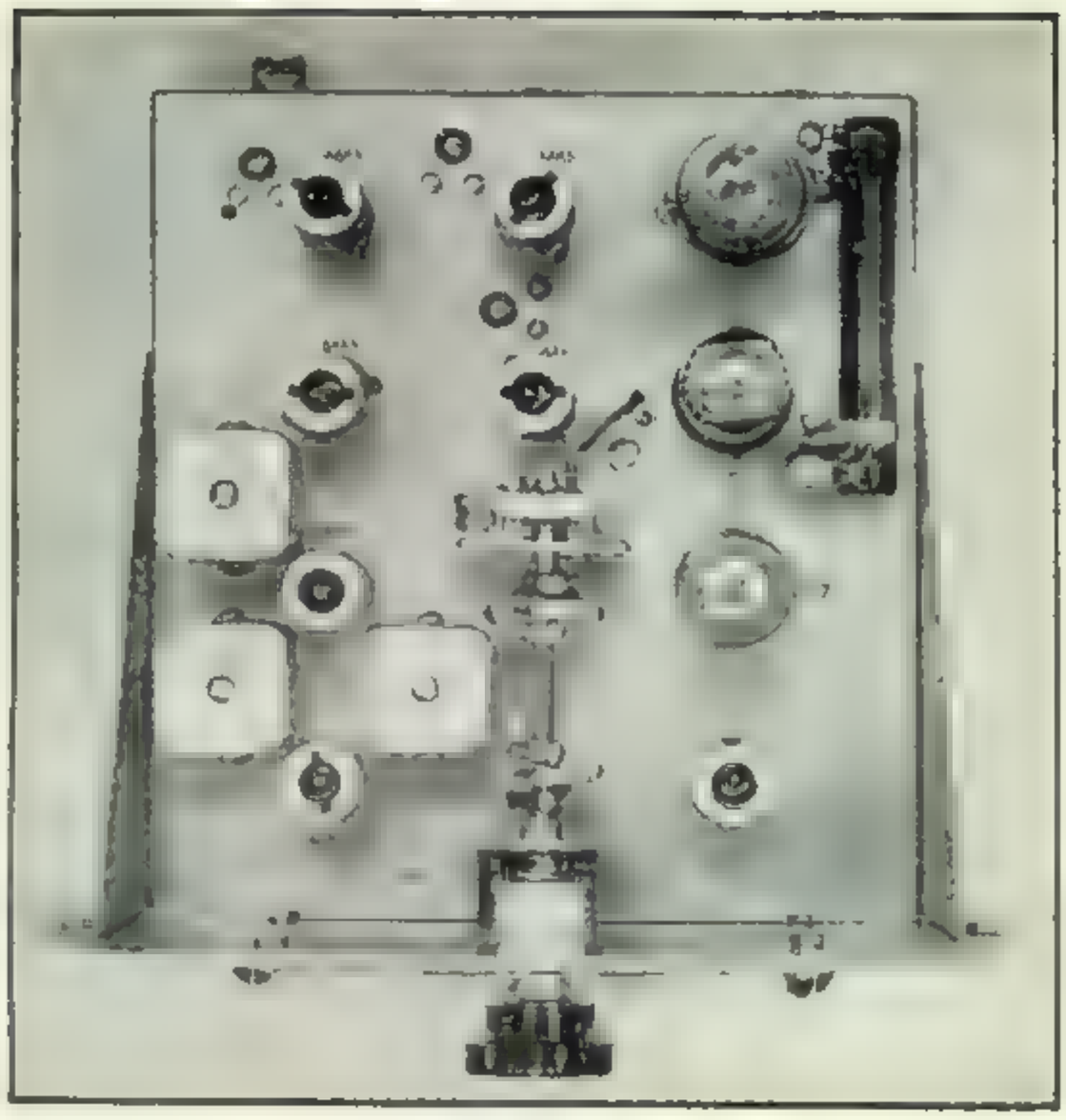


Fig. 5. It is necessary to develop a negative resistance equal to the value of the feedback resistor to keep the gain constant. This shows the method used. The condenser values are fairly critical. Note the similarity to a Colpitts oscillator.

Since this is the tube that we wish to control by varying the gm it is necessary to use a pentode having separate cathode and suppressor base pins. This allows control of the plate current gain by grounding the suppressor and moving the grid-cathode up and down in relation to the suppressor or ground. . The similarity of *Fig. 5*. to a Colpitts oscillator may be noted. This makes the value of *C2* quite important if we are to avoid unwanted oscillation in this stage. The proper value of *C2* is that value which *just* does not permit oscillation. This value will vary from circuit to circuit because of the layout and the stray wiring capacities.

Construction

The chassis layout may be seen in the illustrations, *Fig. 6* and *Fig. 7*. Only three controls appear on the panel—they are the vernier dial, the audio gain control (*R16*) and the selectivity control (*R10*). The power supply is mounted externally and since the power requirements are quite modest any supply capable of 300 volts at 120 ma may be used. The octal female sockets for the speaker and power



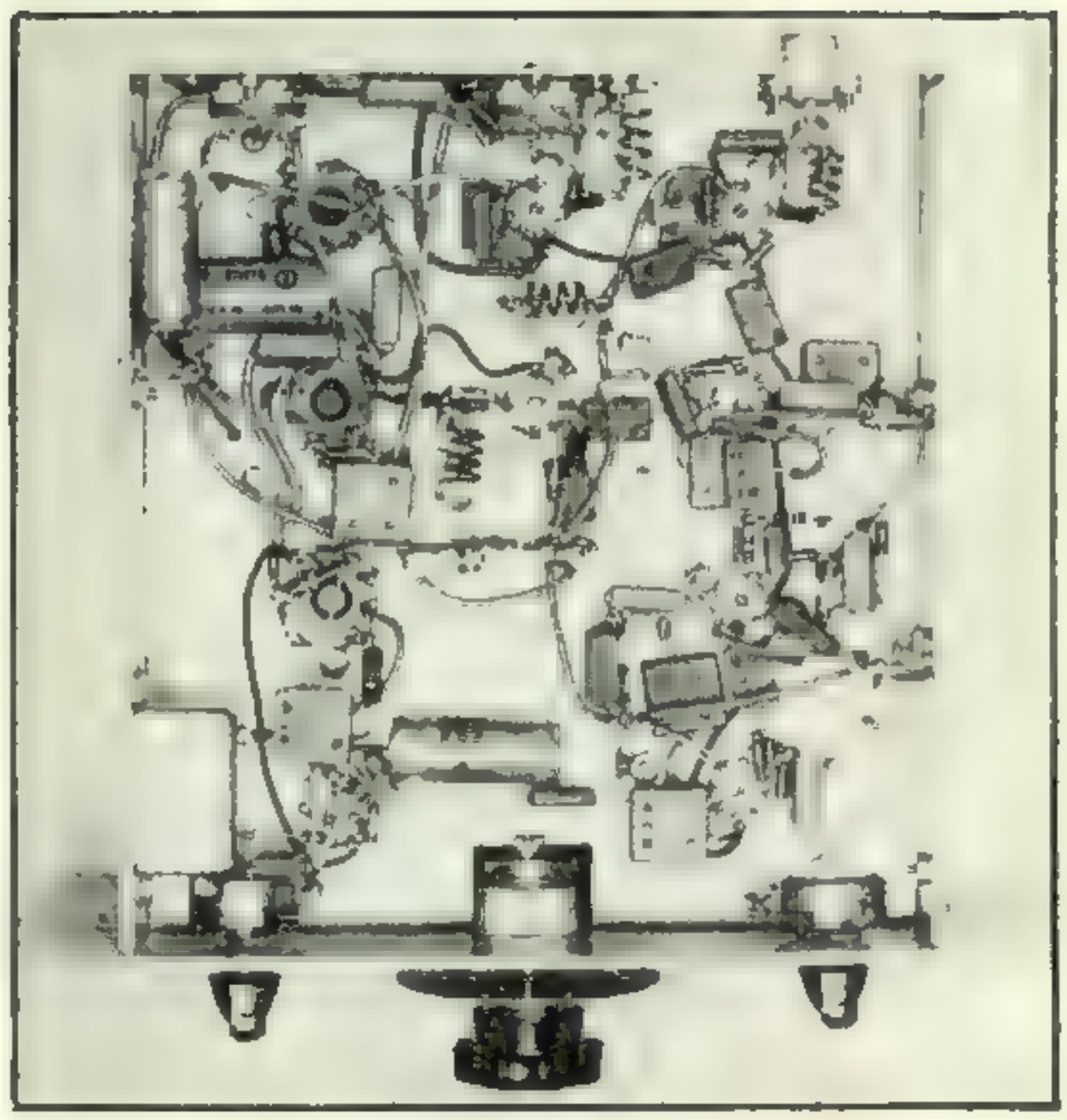


Fig. 6. Top view of the Varif. Only one tuning condenser is necessary since all r-f and mixer grid circuits are broad-band amplifiers. The voltage regulator is mounted on this chassis to allow the use of any convenient power supply. Fig. 7 (right). Underside view of the Varif. The visible coils are those used in the r-f stages and the mixer oscillator. All i-f coils must be enclosed in shield cans.

supply along with the coax antenna socket are mounted on the rear skirt of the chassis.

The coils for the r-f stages, the mixer and the oscillator are all made of No. 18 enameled copper wire, wound on a quarter-inch form, then removed and stretched to a length of 5/8 inch. The coil length is uniform since the tuning condensers, *C1*, *C5*, *C9* and *C14* afford a rather wide range of tuning adjustment. Generally speaking it will take only about one $\mu\mu$f to change the frequency one megacycle with these particular coils. The r-f coils are soldered directly on the silver ceramic condensers with leads not over one-quarter inch long. Holes have been drilled in the top of the chassis to permit tuning during the alignment process.

The first r-f coil is tapped 1/2 turn above ground for matching a 50-75 ohm feedline impedance. A 300-ohm line should be tapped about 7/8 turn above ground although the change is not very noticeable. On the oscillator coil, the tap is made at one turn above ground. All leads should be as short as possible and all grounds should be good grounds for r-f at 144 mc.

The oscillator tuning condenser is a 25-$\mu\mu$f air padder with all but one rotor and one stator plate removed. The original spacing is maintained. A quarter-inch OD hollow shaft was pressed on the rotor shaft to provide standard size coupling facilities. This condenser should be located as close as possible to the oscillator tube and at the same time present very short leads to the oscillator tank coil.

The 10-mc i-f coils are also homemade and are wound on small molded forms equipped with pig tails. The forms are 3/16 inch in diameter and the coils consist of 38 turns of No. 30 enameled wire close wound. Solder the ends of the coil wire to pig tails and mount the coil on the silver ceramic condensers together with the silver mica padder condensers. This entire assembly is put inside of a shield can. The cans in this model of the Varif were made from old i-f assembly cans which had been cut down to a length of 1½". A 3/8" hole is drilled in the top of the can to tune the ceramic condenser. The rotor side of the silver ceramic is returned to B+ to eliminate hand capacity effects.

Some special care must be taken in the wiring of the 6AS6 i-f stage. The feedback resistor *R25* is made by Globar to present a minimum of capacity across the terminal ends. Only this particular type of resistor should be used in this circuit. The capacity of *C22* is rather critical and a very good silver mica or ceramicon of 5% tolerance should be used. *C21* may possibly require a slight change in value for different wiring layouts. The need for altering the value of *C21* may be easily established in the following manner. If the receiver gain falls off as *R10* is moved toward maximum resistance it will signify that *C21* is too large. In cases like this a reduction from 430 $\mu\mu$f to about 390 $\mu\mu$f will usually clear up this trouble.

The noise limiter is a simple rearrangement of well-known principles. Since no a.v.c. was contemplated, one-half of the 6AL5 is used as a shunt diode. If a voltage of about 10 volts appears at the junction of *R15* and *R17*, there will be about 7.5 volts applied to the cathode of the 6AL5. The time constant of *R17* and *C30* is sufficiently long that even relatively long noise pulses will be "soaked up" before the cathode potential can rise. Thus, the noise pulses do not appear at the grid of *V8*. It does not do anything about FM—it is simply an audio limiter.

The audio channel is conventional and may easily be modified to suit the individual without affecting the operation of the receiver as a whole. A VR-105 is used to keep the essential voltages fairly well regulated. As a result there is no annoying shift of the oscillator frequency with variations in the line

(*Continued on page 99*)

Operating Characteristics of the 21-mc Band

OLIVER P. FERRELL*

Taking a look at what can be expected on the newest amateur band.

THE PURPOSE OF THIS ARTICLE is to show some of the radio wave propagation characteristics of the 21-mc, or 14-meter, band. Operation at this frequency requires no special equipment or technical know-how than is not already available to the average ham. However, the question of "conditions" is something that may be studied beforehand and which may be of use in deciding whether or not the reader will eventually operate on 14 meters.

While it is admittedly impossible to obtain an over-all picture of 14 meters from this short article, it is useful to "sample" the proposed band under certain operating conditions and see how it will compare with the present 20 and 10-meter bands.

SUB-SOLAR ABSORPTION CONSTANT S_0								
FREQUENCY-MC	3.5	4.0	7.0	7.3	14.0	21.0	27.4	29.7
SUMMER	10.9	8.5	2.8	2.5	.75	.34	.21	.16
EQUINOX	13.2	10.0	3.2	2.9	.80	.37	.23	19
WINTER	17.2	12.7	3.7	3.3	.89	.40	24	.20

Table 1

In general, we should expect to find 14 meters an intermediate band. This has been borne out in this examination. At certain times of the year the 14-meter band will closely resemble 10 meters, while at other times it will remind operators of 20 meters. 14 meters will be a band having distinct characteristics and should prove to be somewhat better for DX than 20 meters because of the longer skip ranges and lower signal absorption. It may prove to be slightly better than 10 meters because it will be open on DX paths for longer periods. The true worth of 14 meters will be proven during the sunspot minimum when 10 meters will be unusuable.

Comparative Skip Ranges

The actual operating conditions on 20, 14 and 10 meters may be examined by a number of different methods. One of these methods, which is illustrated in *Fig. 1*, is a comparison of the skip ranges over various azimuths. This is one of the newer means of portraying the characteristics of high-frequency radio wave propagation. By selecting the time of day and the frequency it is possible to calculate, with the aid of the CRPL D-series Predictions, the minimum skip distance on any azimuth from your location. The method of presentation is a polar coordinate graph.

At the center of the graphs in *Fig. 1* we have New York City. As we follow each azimuth we encounter 100-mile divisions—starting at the inner circle of 200 miles and proceeding to the circumference of the graph which is 2500 miles. Any area encompassed between the line of minimum skip distance and the circumference will be open for F2-layer transmission at the hour and on the frequency in question. When the minimum skip distance line goes beyond the circumference it means that frequency will be closed over those azimuths.

To study the characteristics of the 14-meter band we have chosen three different hours of an average ionospherically quiet day in November, 1947. In the upper left-hand corner of *Fig. 1.* we see the predicted skip distances at 14 mc for 0700 hours EST. To the north of New York City the skip will probably be about 2000 miles. It decreases very rapidly as we progress toward the east until a minimum skip range of 350 miles is reached on an azimuth of 100°. The skip distance then increases to the south and southwest reaching 2300 miles at 240°. There is a slight decrease in the skip range at 260°, but at 270° the skip at 14 mc is beyond the maximum range of a single hop F2-layer transmission. Thus, we should expect to find 20 meters dead from about 270° to 320° azimuth from New York City at 0700 hours EST.

In the upper right-hand corner of *Fig. 1* the skip ranges at 28-mc are depicted. On 10 meters at 0700 hours we will find no signals being received from azimuths 205° to 045°. Due east of New York the skip distance is expected to be about 1200 miles and due south it will be about 1700 miles. In terms of an actual operating forecast we should find 10 meters open to southern Europe and North Africa. Some weak signals probably will be heard from South Africa, while strong signals probably will be heard and worked from the Caribbean area.

The center polar coordinate in the top row shows the predicted 21-mc skip ranges at 0700 hours EST. The general characteristic is a median between 14 and 28 mc. Like the 10-meter band, the 14-meter band will be closed to the west, northwest and north, or more specifically, from 235° to 030°. To the east

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the minimum predicted skip range is about 750 miles, compared to 1200 miles at 28 mc and 400 miles at 14 mc. Due south the skip distance will probably be about 1000 miles, compared to 550 miles on 14 mc and 1650 miles on 28 mc.

The very pronounced similarity between 10 and 14 meters is better illustrated at 1300 hours EST, also the reciprocal characteristics of 20 meters are quite noticeable between 0700 hours and 2000 hours EST.

Comparative Field Strengths

The graphs of skip distance and maximum usable radio frequencies will sometimes give a false impression of the usefulness of the amateur bands. This is due to the fact that they do not include the factors of sub-solar absorption and the absorption index. Most of the absorption of radio wave energy takes places in the D-layer and is directly proportional to the amount of ionization at this level. The ionization density, and hence the absorption, varies with the season and month of the year and the hour of the day. It may be expressed mathematically since the absorption index depends upon the elevation of the sun above the horizon. It is maximum at noon at the control points of the path in question and reaches a zero value when the sun is approximately 10° below the horizon. This relationship is not valid in the auroral or polar regions where more absorption occurs due to geomagnetic effects.

Table 1 gives the approximate sub-solar absorption constant values for the seasons of the year at various frequencies. It is interesting to note the rapid decrease in the constant between the lower frequency amateur bands. This is the outstanding reason for the greater signal strengths at longer distances using

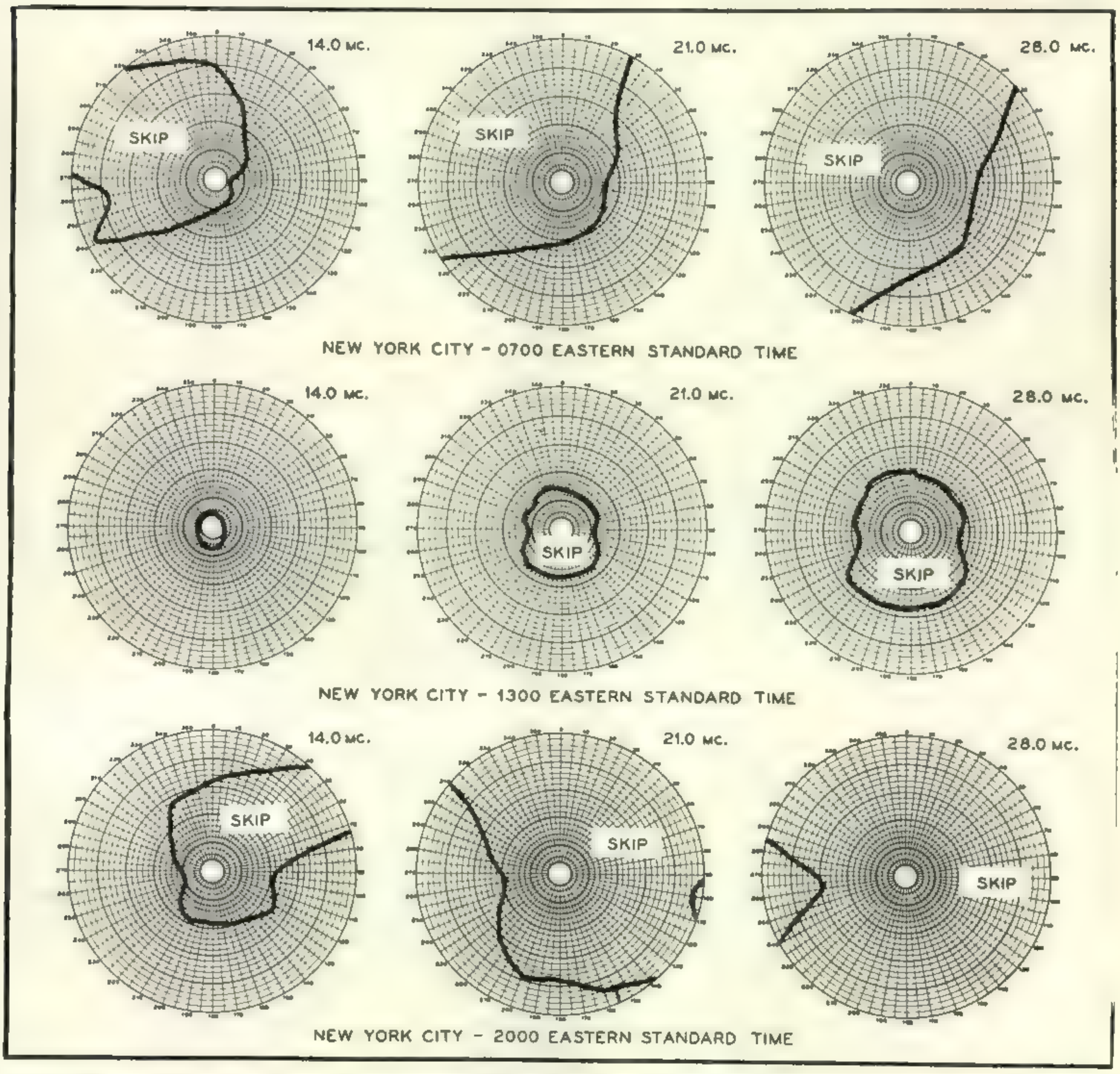

Fig. 1. Plotting of the skip ranges for November, 1947 from New York City. Areas between the minimum skip range and the perimeter of the polar coordinate graph indicate azimuths and distances open for single hop F2-layer transmission. Each circle represents 100 miles starting at the circle 200 miles. The edge of the graph is beyond the limit of a single hop, or 2500 miles.

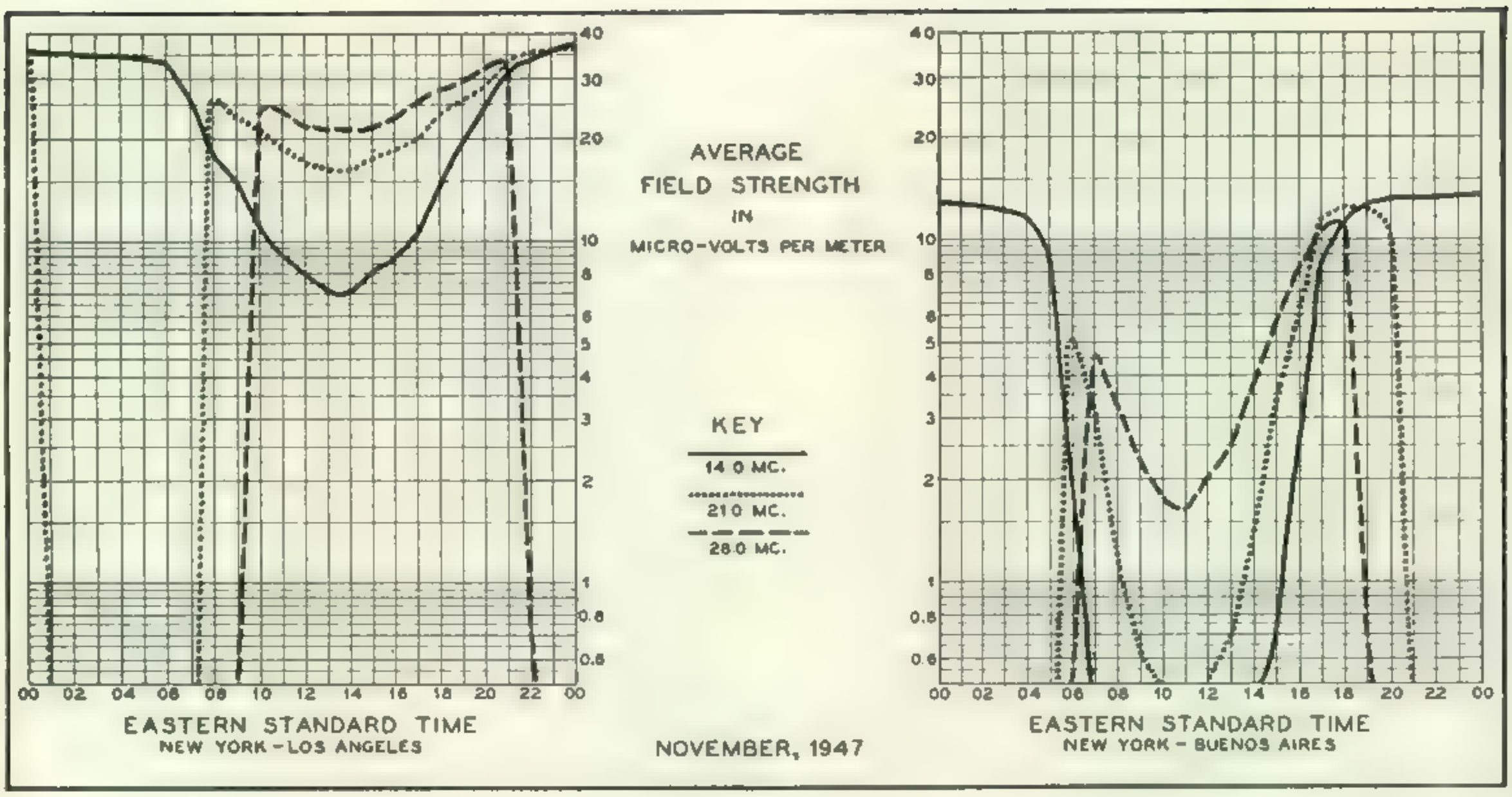

Fig. 2. Averaged predicted field strengths from 1000 watts effective radiated power.

the higher frequencies. When the sub-solar constant is employed in conjunction with the averaged absorption it is possible to calculate the expected field strength over any path.

To obtain the average field strength it is necessary to know the effective radiated power from the antenna—in amateur work for this case, this is assumed to be 1000 watts. The value of 1000 watts lends itself to ease of calculation and in many instances may be the maximum field strength expected. Note that the effective power radiation includes the so-called power gain of the beam antenna.

There is considerable variance in the "required field intensity" for each individual amateur location. This means the minimum field strength to provide a readable signal. At the lower frequencies this is limited by the atmospheric noise, but at the higher frequencies man-made interference and receiver sensitivity enter into the picture. Certain generalities may be drawn in the following manner. In a very quiet location with excellent receiver sensitivity a phone signal of about 0.9 μv/m may be 100% readable. A c-w signal of 0.2 μv/m may also be 100% copy. With a moderate noise background, values of 10 to 20 μv/m for phone and 1 to 4 μv/m for c.w. may be necessary. A very noisy location will probably require upward of 50 to 60 μv/m for 100% readable signals. Poor receivers raise the "required field intensities" by very large amounts. Basically, however, this is a problem of each amateur's installation.

The two graphs in *Fig. 2* show the average predicted field intensities over two paths for November, 1947. The right-hand graph depicts the 20, 14 and 10-meter band conditions from New York City to Buenos Aires. The left-hand graph illustrates the conditions from New York to Los Angeles. With the aid of these two graphs we may clearly see the reciprocal conditions existing between 10 meters (dashed line) and 20 meters (solid line). Note in particular that this graph also depicts the opening and closing times on each band. As seen in *Fig. 2*, the 14-meter band forms an intermediate between 20 and 10 meters. In the right-hand graph (New York-Buenos Aires) the 20-meter band will probably remain open throughout the entire night and will close down just after sunrise. Then after 1430 hours EST, 14 mc builds up slowly to a broad peak beginning at about 1900 hours EST. On 28 mc (dashed line) this path would be closed throughout the night, but will open sharply after 0600 hours EST. There is a pronounced peak at 0700 hours followed by a lull at 1100 hours EST. A gradual buildup of signal strengths occurs in the afternoon until a major peak is reached at 1730 hours

There are several noticeable distinctions between the 10 and 20-meter bands and the 14-meter band over the path from New York City to Buenos Aires. The 14-meter band opens approximately one hour before 28 mc and reaches a slightly higher peak at 0600 hours than 10 meters at 0700 hours. However, like 20 meters it is closed throughout a portion of mid-day. Recovery is somewhat faster than 28 mc and a fairly strong peak will be reached between 1700 and 1900 hours. This latter peak will probably provide better signals than 10 meters because of the ideal skip distance and slower QSB and would be better than 20 meters because of the slightly less absorption.

The path from New York to Los Angeles (left-hand graph, *Fig. 2*) gives a better idea of the 14-meter band at its best. During the day the three amateur bands portray similar characteristics. 20 meters (solid line) will be open throughout the night with a maximum field of about 36 μv/m. A drop in signal strength begins after sunrise and reaches a minimum of about 7 μv/m at 1330 hours EST. The 10-meter band (dashed line) opens shortly after 0900 EST and maintains fair signals during the day until a peak at 1900-2000 hours EST. The 14-meter band (dotted line) will open about two hours before 10 meters and, although following the general pattern

during the daylight period, it will remain open until after midnight. On a comparative signal basis the 20-meter band signals will be about 10 db below those on 10 meters, while those on 14 meters will probably only be about 2 db below those on 10 meters.

From a combination of *Fig. 1* and *Fig. 2* we may obtain an over-all picture of what is meant by an "intermediate" amateur band. Note, for example, 2000 hours EST. On 20 meters the skip distance is just right to provide very strong signals from the Chicago, Milwaukee-Louisville-St. Louis areas. The average maximum field strength is expected to be about 24 μv/m. On 10 meters the skip distance is now over 1400 miles to the west and southwest with good signals coming into the New York area from west of the El Paso-Denver line. The maximum field will probably be about 32 μv/m. On the intermediate band—14 meters—the skip range is now beyond the well-populated amateur areas in Chicago-St. Louis, but strong single-hop signals are coming in from west of the Kansas City-New Orleans line. Thus, if the question were a contact with a station in Los Angeles we find that 10 meters is open, but will soon close on this path. On 20 meters we would have to fight through the QRM from the stations in the mid-west. However, on 14 meters we may expect to find less QRM coupled with somewhat stronger signals for the next several hours.

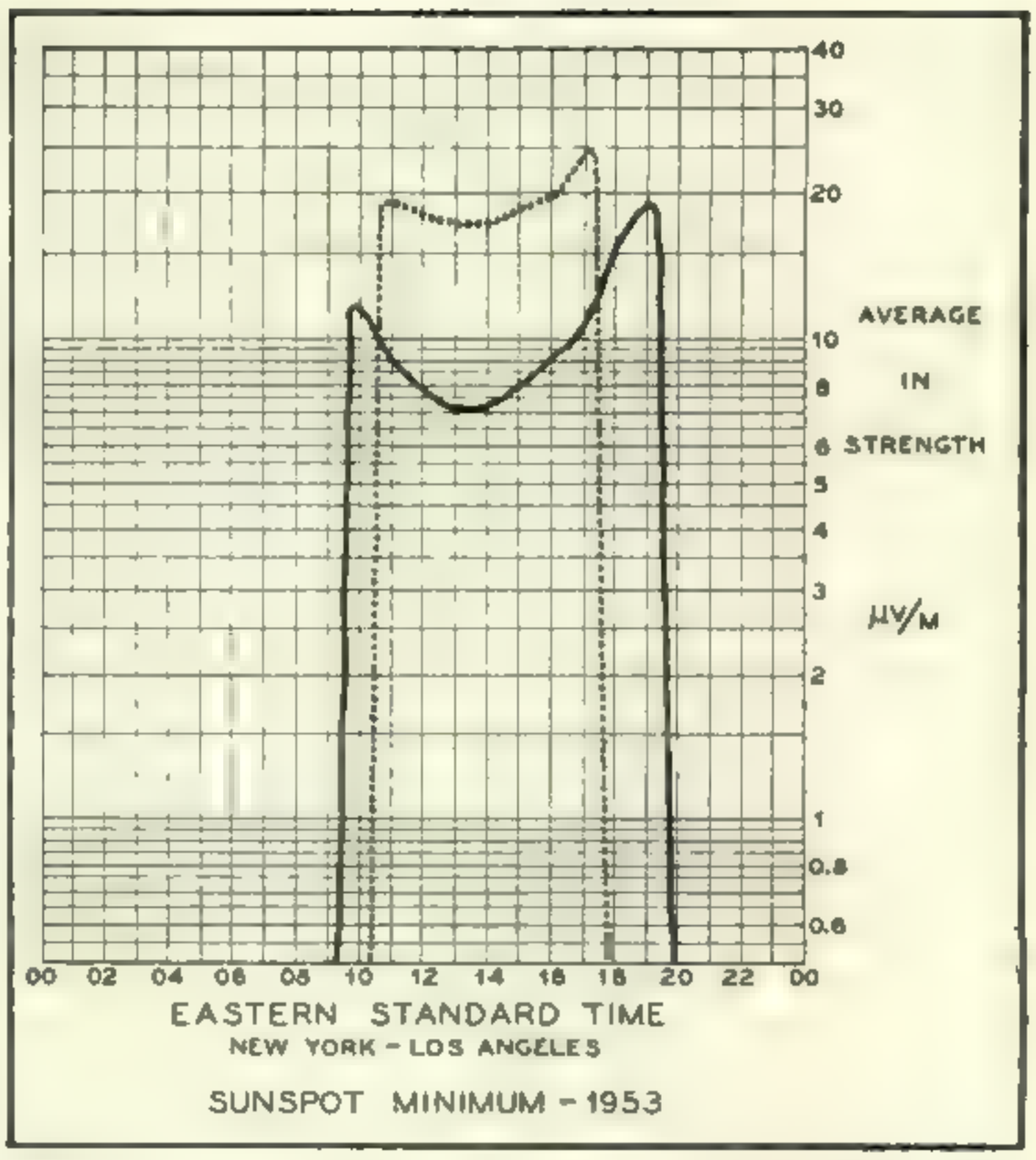

Fig. 4. Averaged predicted field strengths from New York to Los Angeles during the next sunspot minimum. The 10-meter band is unusable for F2-layer transmission. Compare this graph with the left hand graph in Fig. 2.

The Sunspot Cycle

The above discussion, however, considers only the 21-mc band during one very small part of the sunspot cycle. While most amateurs are familiar with the sunspot cycle, too few know to what extent the sunspot minimum will affect 20, 14 and 10 meters. This is probably due to the fact that the last sunspot minimum occurred in early 1944. At the time the amateur stations left the air in 1941 the sunspot cycle had decreased only approximately 35% of its maximum—minimum value.* At the return of the amateur bands in 1945-46 the sunspot cycle had swung through a pronounced minimum and was then higher than when the amateurs had left the air in 1941. Thus, actually the only sunspot minimum experienced recently by radio amateurs was in 1933. This has created the impression that the 10-meter band is always workable. *Fig. 3* shows that this is not true. By using the comparative figures of the last sunspot minimum we have projected ourselves into the next minimum of 1953-54.

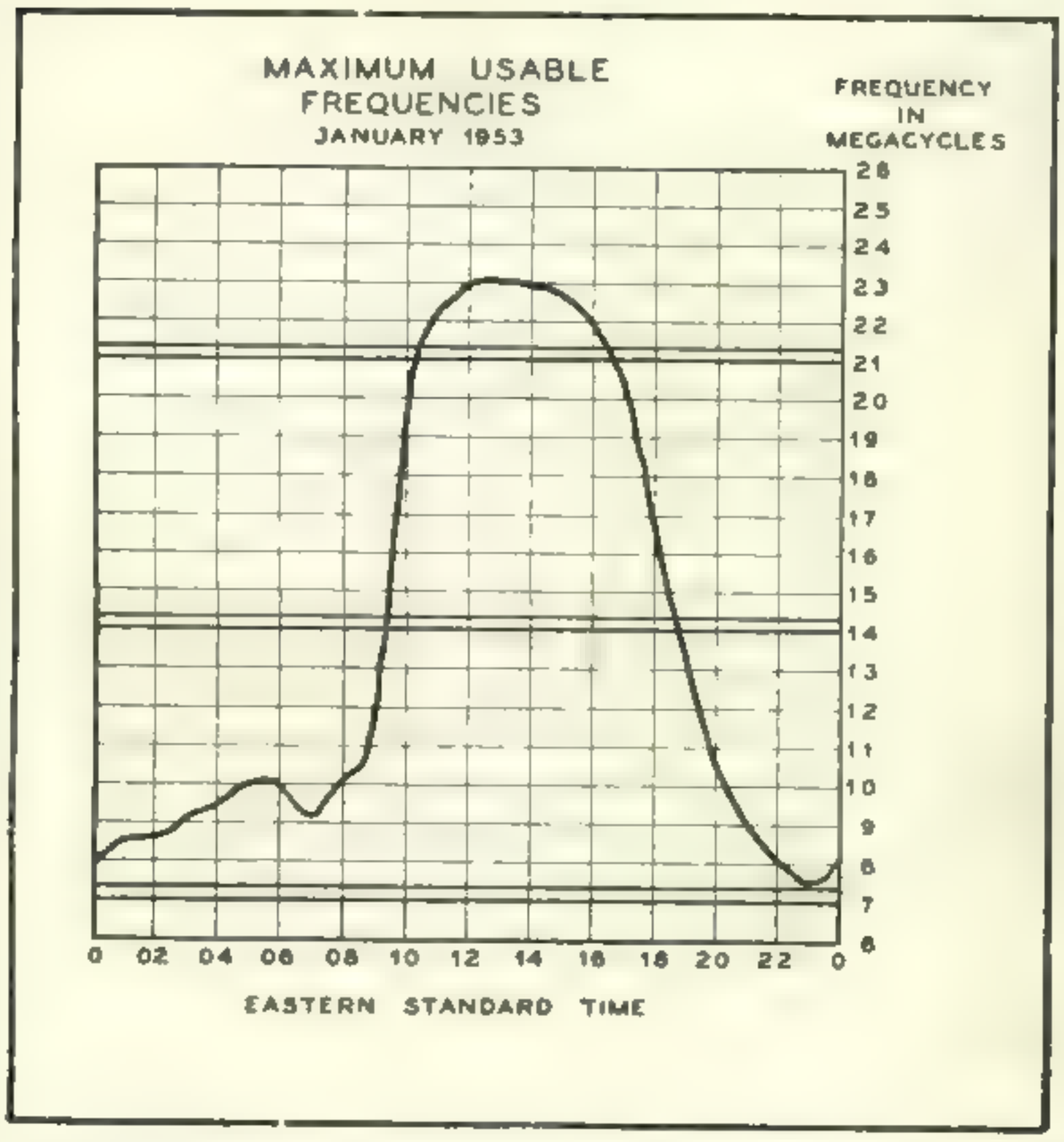

Fig. 3. Predicted maximum usable frequencies during the winter of 1953 at the sunspot minimum.

Fig. 3 depicts the maximum usable frequencies over the path from New York City to Los Angeles during the winter of 1953. In this we see that the MUF will probably not exceed 23 mc (at the present time the MUF is about 45 mc). In *Fig. 4* the MUF outline has been replotted to show the average predicted field strengths for the same period. Compare *Fig. 4* with the left-hand graph of *Fig. 2*. The much higher field strengths obtained on 21 mc are particularly noticeable during the sunspot minimum.

It can be concluded from the information outlined that 14 meters will be a good DX band exhibiting skip characteristics just about mid-way between 10 and 20. However, as DX conditions deteriorate on 10 meters as we approach a sunspot minimum, 14 meters will hold up much better and may prove open throughout the long periods when 10 may be expected to be dead.

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*This may not present an entirely true picture since contact with foreign amateurs was prohibited and many other stations were off the air in 1939-40.—*Ed.*

Converting the SCR-274N Receiver

RUSSELL F. SIEVERT, W8OZA*

One of the top buys in surplus, modification of the 274N receiver series for a-c or d-c operation is extremely simple.

DURING THE PAST few years the conscientious radio amateur has turned his attention more and more to the construction of portable-emergency equipment, which could be easily transported from one location to another at a moment's notice. Unfortunately, the attention given this type of equipment has been heavily lopsided in favor of the transmitter and those among us with a truly portable receiver are rare indeed. We are not entirely to blame; constructing a decent superhetrodyne receiver is by no means a simple job and since the manufacturers started building receivers with provisions for an external power source it has been easier to take along the home station receiver.

However, we can now all have a really portable job for a cost of from ten to twelve dollars. The "break" comes in the form of the BC-454-A and the BC-455-A government surplus receivers which form a part of the SCR-274N aircraft equipment. The two models available cover the tuning ranges of 3 to 6 mc and 6 to 9.1 mc respectively, and the circuits of both are nearly identical. The receivers are six-tube superheterodynes employing a 12SK7 t-r-f stage, a 12K8 mixer, two 12SK7s as i.f.s, a 12SR7 second detector and b.f.o. and a 12A6 audio amplifier. In the case of the 3 to 6-mc unit the i-f frequency is 1415 kc and in the higher-frequency model the i-f frequency is 2830 kc. The conversion data discussed can be applied to either unit without change, except for one item which will be described in detail further on in the article.

Built for the government, these receivers were designed to operate from a 24-volt d-c source which powered a small dynamotor mounted on the rear shelf of the chassis. The revamped job can be operated from either 110 volts a.c. or an external 6 or 12-volt a.c.-d.c. filament supply and 250-volt d-c plate supply. This is accomplished by means of a small a-c transformerless power supply and a six-pole two-position rotary switch. The power supply uses a 25Z5 in a conventional voltage doubler circuit but the whole secret to the receiver's versatility is centered around the aforementioned rotary switch. As

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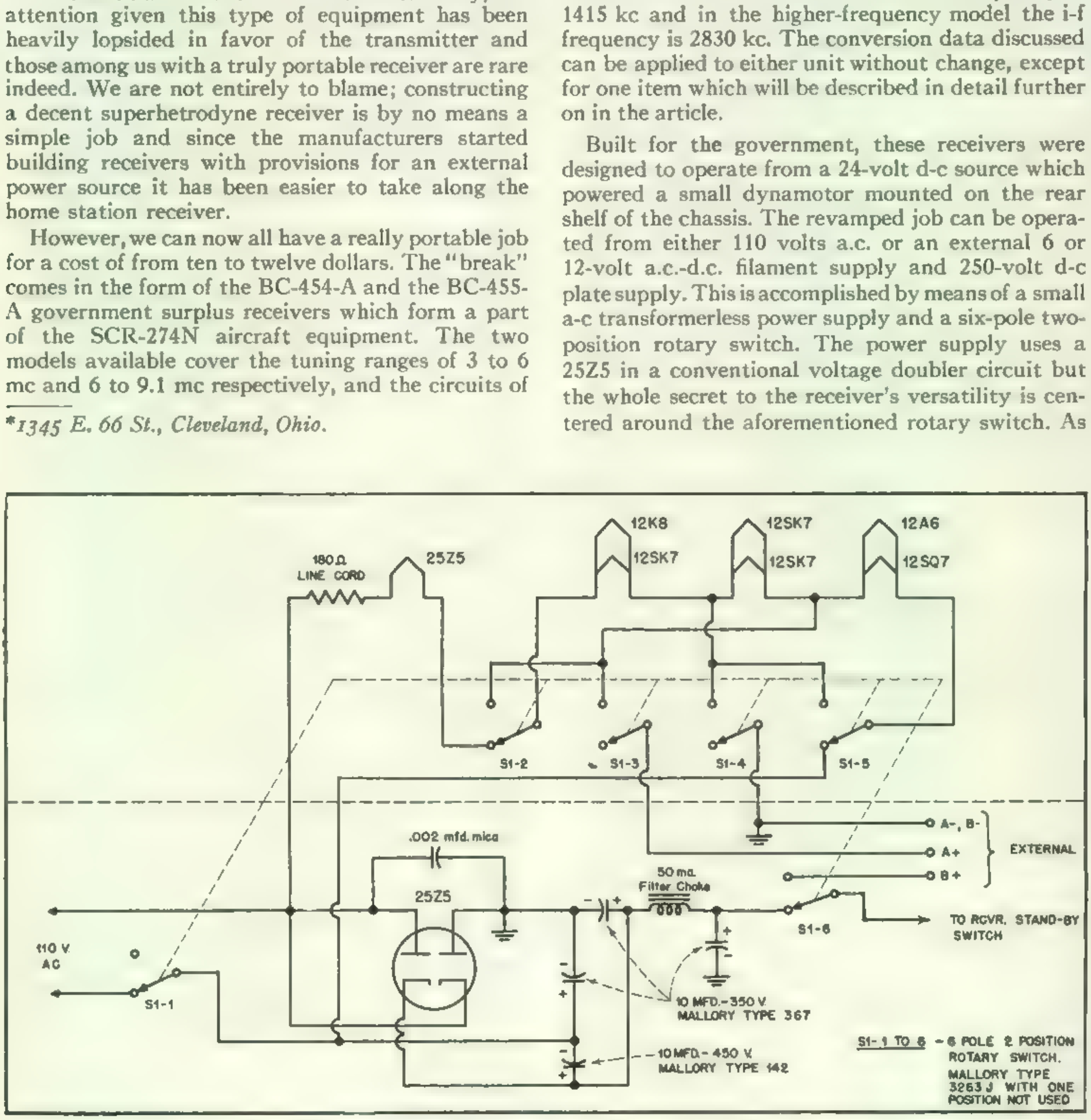
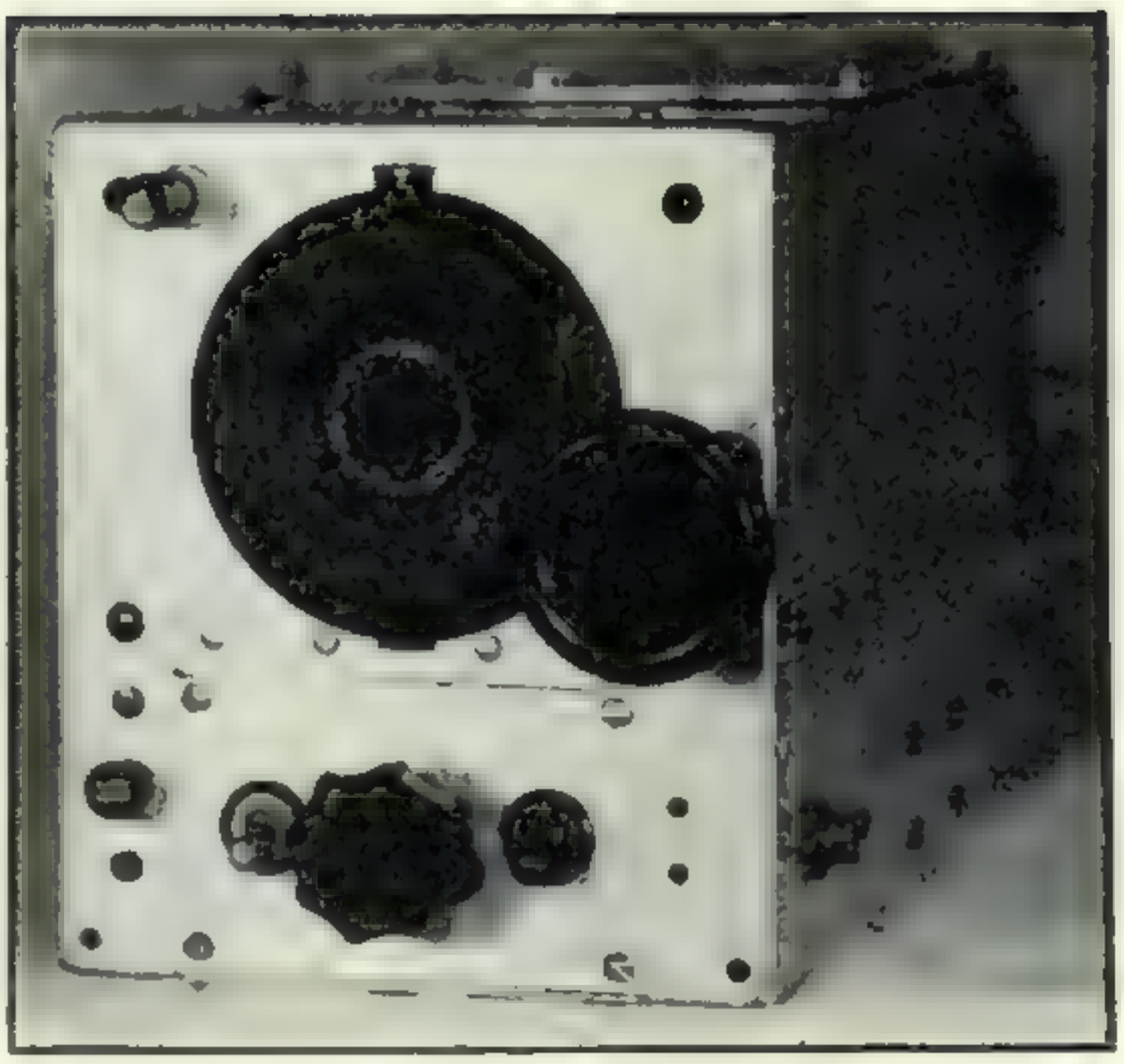


Fig. 1. Circuit diagram showing changes required for a-c or d-c operation. Part A is top, B is bottom.

will be seen from a study of the circuit diagram, this switch actually makes a complete change in the filament circuit. When it is in the position shown in the diagram the filaments are connected in a series-parallel circuit, with the 25Z5 voltage doubler cut in to supply power. It is necessary to have the tubes in the receiver proper wired so that two tubes will be in parallel in order to balance the filament current at .3 of an ampere. This seemed more desirable than using a .15 - ampere filament tube such as a 35Z5 in the power supply and having to sacrifice the extra voltage gained by using a voltage doubler.[1] When the switch is thrown to its second position the 25Z5 is completely removed from the circuit, all other filaments are connected in parallel and the leads for supplying filament and plate voltage are extended through to a set of terminals on the rear of the power supply shelf.

The first step in the modification is the preparation of the chassis for the addition of the power supply, plus the removal of the unnecessary parts. Remove the bottom cover plate and the large shield can which encloses the tubes and i-f transformers. Unscrew all of the metal-cased condensers, chokes, etc., from the sides of the chassis and remove the two screws holding the antenna, oscillator and mixer coils in place. With the exception of the square b-f-o transformer there is sufficient slack in the wiring to permit these units to be laid out over the sides of the chassis. The b-f-o transformer can be shifted far enough to be out of the way but care should be exercised to prevent breaking off the lugs to which its connections are made. The coils are of the plug-in type and may be entirely removed until the conversion is completed. The tubes and plug-in type i-f transformers should be taken out similarly and placed aside. Completely remove the metal-cased condenser mounted directly over the dynamotor connecting plug, the small mica condenser going from ground to one of the pins on the socket on the rear of the chassis and the dynamotor plug and its associated wires. Between the beat oscillator transformer and the 3 x .22-μf condenser across from it are two upright mounted black resistors. These were



Front view showing addition of tuning knob, gain control, stand-by switch, and b-f-o switch.

originally provided to furnish a dividing network for obtaining screen voltage. Since the power supply now being installed will give only about 210 volts this network is no longer required and the resistor nearest the b-f-o transformer is removed, leaving only a series resistor in the screen circuit and thereby giving an increased voltage. The four dynamotor mounting cushions are taken off by unscrewing the nut on the bottom of the chassis. All of the remaining leads going to the socket on the rear of the chassis are now completely removed and the socket itself is taken out. This completes the dismantling at the rear of the chassis and we can now begin to prepare the front end for the necessary revisions.

The first item to be removed is the 3-μf condenser fastened to the front panel alongside the remote control box. Remove the remote control box and the leads going to its socket with the exception of the black lead and the one remaining green lead, which should be cut only at the control box socket and left in place for further use.

Now that all of the "surplus" surplus has been removed we can go to work and put it together the way we want it. The first job of course is to rewire the filaments in accordance with the diagram shown in *Fig. 1*. The leads going from the tube sockets to the switch should be soldered in place at the socket end and fed through the left rear hole in the chassis which has been provided by the removal of the dynamotor mountings. These leads should preferably be color-coded so as to facilitate their later being connected to the six-pole two-position rotary switch. The next step is the installation of the controls on the front panel. These include a SPST toggle switch to be used as a stand-by switch, a 50,000-ohm potentiometer for a gain control and a second SPST toggle switch to control the beat oscillator. The controls are all mounted on the front plate of the remote control box which is completely dismantled for this purpose. The three holes left in the center of this plate, after the knob and socket supports

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[1]It would, of course, be possible to construct a voltage doubler supply utilizing selenium rectifiers. Then the heaters could be connected in series and operated directly from the 117-volt a-c input if a 50L6 were substituted for the 12A6 (VT134). Screen voltage for the 50L6 would have to be limited to 110-volt d.c. requiring the addition of a screen dropping resistance, or bleeder and the inclusion of an audio bypass connected between screen and ground.

If a half-wave supply were used in place of the voltage doubler, no modification in screen wiring would be required in substituting the 50L6 for the 12A6. By the use of a half-wave supply, the receiver can be used on either 117 volts a.c. or d.c.

In either case, the substitution of the 50L6 for the 12A6 requires a 150-ohm cathode resistance in place of the 1500 ohms (*R21*) used with the 12A6. The substitution of a 50L6 in place of the 25Z5 permits full series operation of filaments and elimination of line cord filament dropping resistance.

The power supply fits in the place formerly occupied by the dynamotor. The rotary switch is S1.

have been removed, are used as the centers for mounting the three items. The green lead which previously went to the remote control socket goes to the gain control and the arm of the gain control goes to ground. The switch used for the b.f.o. has one connection going to ground and the other to the 3 x .05-μf condenser mounted alongside the b-f-o transformer. This lead connects to the terminal on the condenser to which is already fastened a 5100-ohm resistor. One of the stand-by switch leads goes to the terminal nearest the chassis of the remaining large black resistor and to the terminal on the rotary control switch shown in part *S1* of *Fig. 1*. The output jack is mounted on the side of the chassis next to the b-f-o switch and can be installed without insulating washers. The only connection necessary is the black lead previously removed from the remote control socket.

The final job is the construction of the power supply, the circuit diagram for which is shown in part *B* of *Fig. 1*. This supply is built on an aluminum shelf measuring 3" x 4½" with a rear drop of 1". Once the power supply has been completed the receiver shield can may be reinstalled, the power supply bolted in place on the receiver proper using four 1" spacers, and the remaining filament and output connections soldered in place. When soldering these last leads in place it may be wise to leave a small amount of slack in the wires to provide for future servicing.

Installation of a Tuning Control

Two methods of installing a tuning knob may be used. One is to remove completely the threaded bushing over the geared shaft to give sufficient clearance for a ¼" solid coupling and the other is to use a short section of ¼" copper tubing adjusted to fit snugly on the geared shaft without removing the bushing. The author chose the first method, but only because the coupling was more readily available. The first system involves the complete removal of the tuning condenser and is therefore not recommended. If the first method is chosen the bushing should be removed before the power supply is bolted in place, since the receiver shield cans cannot be removed with the power supply securely fastened.

That about winds up the conversion of the receiver as far as necessary changes are concerned, but there is one thing more that can be done to make it still more adaptable for ham use. Like most equipment designed for military service, this unit is long on performance but short on bandspread. The particular unit the author converted was one that tuned from 6 to 9.1 mc and by removing all but two rotor plates from each section of the tuning condenser and adding small trimmer condensers to compensate for the loss of capacity, it was possible to spread out the 40-meter band to occupy a total of fifteen divisions on the dial, or 20 kc per division instead of the original 100 kc per division. No information is available on the number of plates to be removed from the 3 to 6-mc model, but this can be easily determined by removing the plates one at a time until the desired coverage is obtained. On the 6 to 9.1-mc model, trimmer condensers with a maximum capacity of 45 $\mu\mu$f were found to give excellent range since the maximum capacity of the original tuning condensers is 66 $\mu\mu$f. On the 3 to 6-mc model the maximum capacity of the tuning condensers is 147 $\mu\mu$f. This would indicate a trimmer condenser with a maximum capacity of about 125 $\mu\mu$f.

To operate the completed receiver merely throw the rotary switch to the desired position, either series or parallel and connect the proper supply voltage. With the switch thrown so that the filaments are all in parallel the operator can substitute 6-volt type tubes and run the whole works from a single storage battery with a vibropack furnishing the high voltage. When using 6-volt tubes a 6K6 should be used in place of the 12A6. If *only* earphone output is desired, a 12J5 can be plugged in place of the 12A6 (with 6-volt tubes, substitute a 6J5 or 6C5) with saving in power supply drain.

Considering its cost, this little unit leaves nothing to be desired and makes a useful adjunct to any station. W8AZ has even mounted a small 3" speaker on the top of his receiver and uses it as a monitor for his home rig when he is not operating in the field.

S & W is a department for the ham gadgeteers and workshop experts. All readers are invited to pass along ideas. Don't worry about literary form—just get your ideas down on paper and include rough sketches, diagrams or photos if you have them. Be sure to give your name, call and QTH. Send as many items as you choose and for each one published we will send along two crisp new dollars. Address all contributions to S & W Department, CQ, 342 Madison Ave., N. Y. 17, N. Y.

Inside the SHACK AND WORKSHOP

Conducted by A. DAVID MIDDLETON, W1CA*

Finding a Short in 115-volt Wiring

The next time a short occurs in the shack or transmitter 115-volt wiring, try this stunt in testing and locating the short. Don't just screw in another fuse, after you *think* you have found the trouble, it may blow, too!

A safe method is to disconnect all gear from the line, then substitute a 115-volt lamp bulb for the fuse. (Sure, there *should* be a fuse in the 115-volt circuit). Then, if the short is still present, the bulb will light. Of course, if the short has been removed, the bulb will not light.

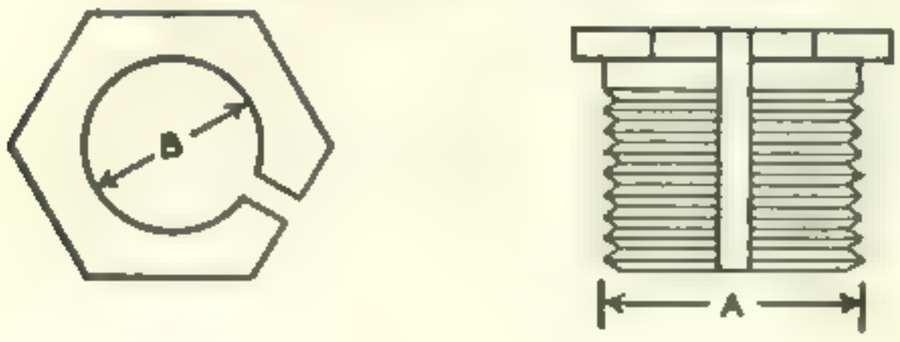
A short can also be *located* by using this method, as the line voltage may be applied and the wires jiggled or moved at various spots. This method works even better on those infernal intermittent shorts.

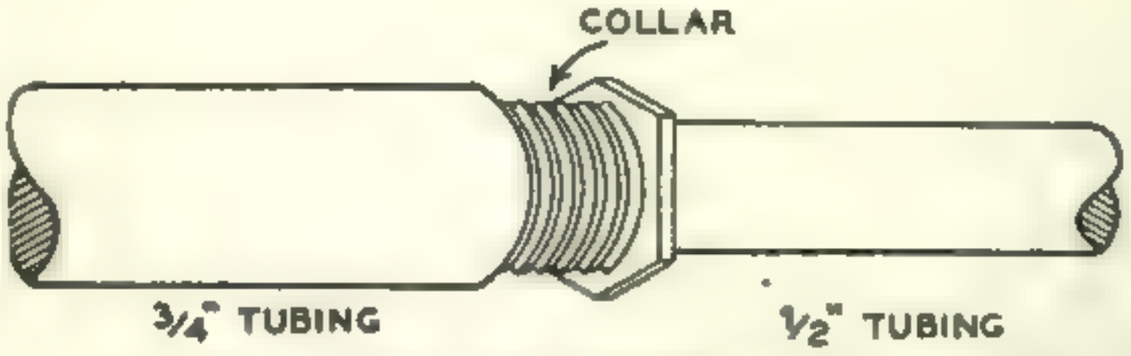
Milt Kalashian, W1NXT

Clamp for Telescopic Antenna Elements

A simple but effective clamp for telescopic antenna elements can be made from the "clamps" or "collars" used in conduit work. Thus, for example, a section of ½-inch tubing is used inside a piece of ¾-inch stock and a "collar" is slid over the smaller tubing and threaded into the outside tubing. Threading the "collar" into the larger tubing, forces the collar to clamp down on the inner tubing. The collar can be forced into place by turning it with a wrench, while holding the tubing with a Stillson wrench or a pair of "pipe" pliers.

DETAIL OF CONDUIT COLLAR





ASSEMBLY OF TELESCOPIC ELEMENTS

The conduit clamp or collar is shown in *A*, above, and a typical telescopic element assembly is depicted in *B*.

A vertical 10-meter antenna using these clamps has withstood several severe storms at WØIWT.

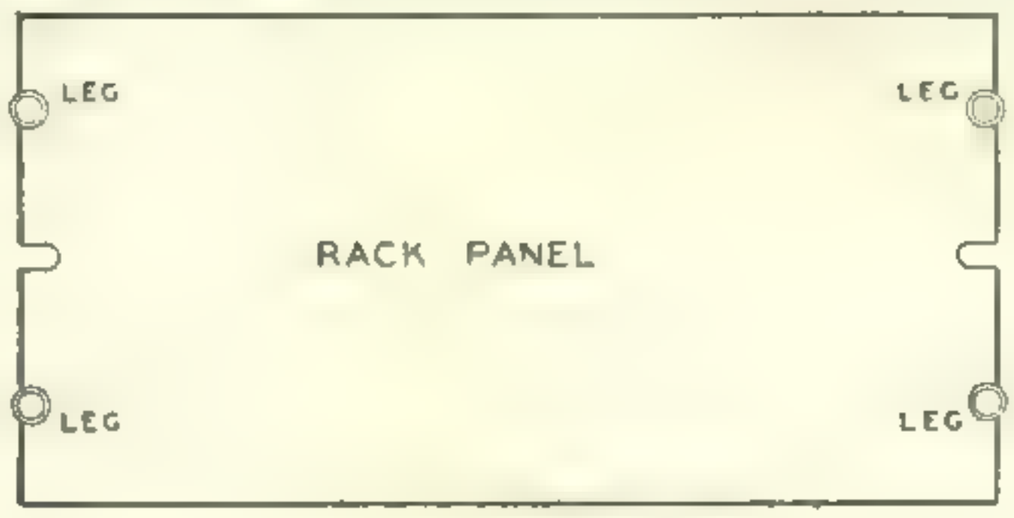
E. V. Stolberg, WØIWT

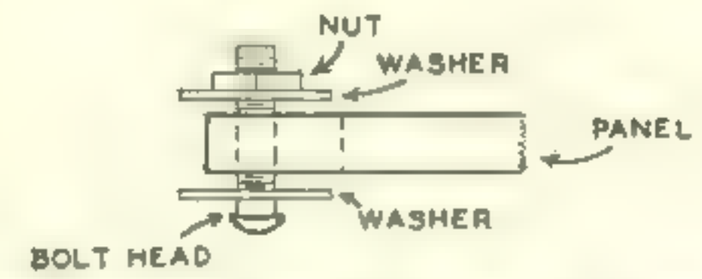
Address all contributions to S & W Department c/o CQ, 342 Madison Ave., N. Y. 17, New York.

Don't Scratch That New Panel While Drilling!

To prevent the marring or scratching of rack panels while drilling, make up four temporary "legs" as shown below and keep the panel off the bench.

Two oversized Bakelite insulating washers and a small bolt make up each leg as shown in detail.





After these temporary legs are installed, the panel can be handled on the bench without the usual danger of filings or small parts scratching the finish.

Alvin U. Haugen, WØPRZ

Replacing the 6C5 or 6J5 Receiver Oscillator

Many receivers using a triode for the local oscillator have a tendency to drift. Some of this drift may be reduced by replacing the 6C5 or 6J5 with a 955 acorn triode.

An adapter may be made from a large octal tube base (such as 6L6G) by placing two spade lugs in the acorn socket holes. Bolt these spade lugs to the tube bass. Cross-connect the proper wires to their respective pins on the tube base. Replace the present 6C5 or 6J5 with the adapter, plug in a 955 tube and reset the oscillator.

If a combination mixer-oscillator tube is used, some other arrangement will be required, such as a 954 or 956. However, on the 6C5-6J5 type oscillator the change may be made easily and effectively.

Felix W. Mullings, W5BVF

Reducing Terminal-Strip Breakdowns in Modulation Transformers

My multi-match modulation transformer broke down between the rivet holding the Bakelite mounting plate and a high-voltage lug, also contained on the plate. The spacing, on this transformer, was about 1/8th inch.

Since there are four holding rivets, two were drilled out, and the flashover path is now sufficiently long to prevent breakdown. The remaining two rivets proved amply strong enough to hold the Bakelite plate.

This type of construction is common among multi-match transformers so this idea may help some other fellow who has had the same trouble.

Fred Craven

Simple Measuring Equipment

ALFRED M. WINCHELL, W1AIY*

Continuing a basic discussion of microwave equipment that can be readily duplicated in the average amateur's shop.

IT IS KNOWN that the number of radio amateurs and experimenters who would like to do microwave work is steadily increasing. It has also been stated that many of these have not had a great deal in line of elementary instruction or experience and that many of those interested in doing v-h-f or s-h-f "plumbing"" were not connected with radar or other microwave projects during the war. With such persons in mind the following pieces of test gear and procedures for using them are described and illustrated. They do not represent the optimum for the radio amateur (due to the lack of precision), but serve simply as a starting point until amateurs have better gear and procedures, which are sure to follow.

For those who live in or near the larger cities there is somewhat less of a construction problem since many components are available through war surplus outlets and a certain amount of shopping around will usually locate quite an assortment of radar gear which has been discarded by the Armed Forces. The majority of such equipment released thus far was designed for use in the 3-cm region of which some is useful for the amateur 10,000-mc (10 KMC) band. Most of the material previously mentioned is designed to match mechanically and electrically into rigid waveguide ½" x 1" *outside* dimension which has an *inside* dimension of 0.400" x 0.900" and also matches flexible waveguide having dimensions described in a previous article†. There have been many klystron tubes of the 723 A/B type released at comparatively low prices and, as these can be used with the ½" x 1" rigid components and as some of them at least can be altered to operate in the 10-KMC amateur band, it would seem as if this band might be a good place to get some microwave or s-h-f experience from an economic standpoint.

Assuming that our new microwave worker will be dealing with a 723 A/B or similar type oscillator, he is apt to have at least two problems right at the start: (1) how will oscillations be detected and output be measured, and (2) at what frequency is this output occuring? At such frequencies and with a few milliwatts of power one cannot consider the old stand-by coil - condenser neon - bulb arrangement for obvious reasons, and, although fairly precise measuring equipment is available commercially, we would like to consider something much less expensive to begin with.

*Technicraft Laboratories, Inc., 237 E. Aurora St., Waterbury, Conn.

†*Winchell, "Introduction to Flexible Waveguides," CQ, Oct., 1946.*

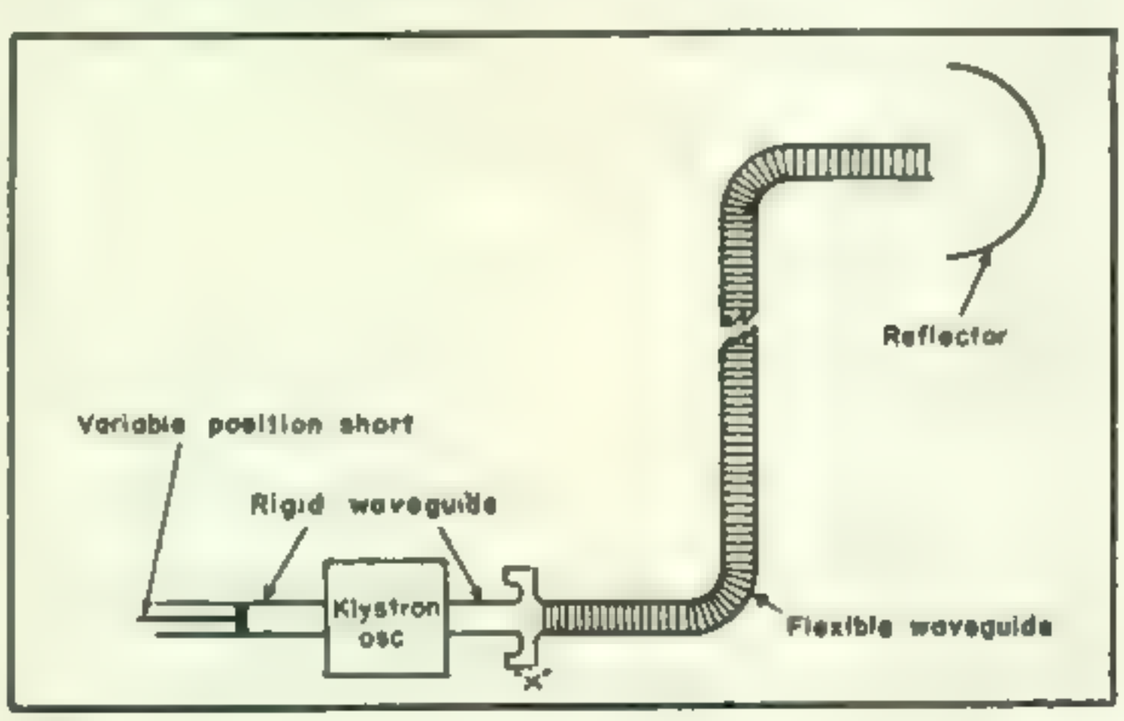


Fig. 1. Schematic of a simple oscillator circuit with flexible waveguide fed "dish."

Checking for R-F

Let us assume our amateur microwave worker is planning to construct a simple modulated oscillator using a low-power klystron tube, the output of which will be eventually connected to a flexible waveguide which will feed some type of a parabolic antenna as indicated in *Fig. 1*. One means to indicate if the oscillator is functioning is to break the waveguide line at the point where the flexible waveguide connects to the rigid ("X" in *Fig. 1*). If there is r-f energy being radiated from the open end of the rigid waveguide it may be detected by placing the field strength meter, as shown in *Fig. 2*, a few inches away from the opened waveguide with the doublet elements perpendicular to the wide dimension of the waveguide. As shown in the photograph, the field strength meter consists of a micro-ammeter with a range of 0-20 or 0-50, for example, across which is connected a type 1N21 or 1N23 crystal. Soldered to the crystal contacts are two inserts from coaxial cable fittings which are utilized in two ways: (1) as half-wave doublet elements for picking up energy when the device is used as a field strength meter for free space microwave measurements, and, (2) for attaching to coaxial fittings connected to cables or to a probe in a waveguide, as shown in *Fig. 3*, for the purpose of indicating r.f. in the guide.

In the latter application the range of the meter and the depth of the probe inside of the waveguide are factors which determine if the meter will go off scale under conditions of maximum power. The device is simple and easily constructed and the waveguide and coaxial fittings may be attached in the home workshop with a gasoline torch and soft solder. It readily indicates fairly small changes in the oscillator's output as adjustments are made.

for Flexible Waveguides

Fig. 2. Microwave version of field strength meter which can be held or mounted near open waveguide line, horn or antenna to indicate output.

By connecting a crystal earphone across the meter terminals, modulation can be audibly checked.

Measuring Frequency

Once we have determined that there is "soup" in the waveguide, let us consider the ever present problem of measuring the frequency. With the indicating device (*Fig. 3*) connected in the waveguide line, a check on the frequency may be made by connecting the waveguide to a Lecher wire bridge by means of a short length of coaxial cable. As the shorting bar on the Lecher wire bridge is moved along, standing wave voltage maximums and minimums will be indicated on the meter. Thus, by measuring the distance in centimeters (by means of the scale on the bridge) between one maximum to the next maximum or one minimum to the next minimum and multiplying by two, the approximate wavelength in centimeters may be arrived at. The precision of such a measurement may somewhat depend upon the care with which the equipment is constructed and operated and therefore edge of band operation is not recommended as determined by this method! However, it does fill a purpose for determining frequency at low cost, and, even though one should try to locate a cavity type wavemeter at a reasonable price (as the writer did for $1.45), there is sometimes the problem of having it calibrated, which at present is not always easily arranged.

The Lecher bridge shown here consists of a "hairpin" consisting of two #14 copper wires spaced about ¼" apart and having an over-all length of approximately 9½", with the coaxial connector soldered to the open end of the bridge. The shorting bar consists of a piece of brass strip approximately 1½" long and ⅜" wide which makes contact with slight pressure against the Lecher wires and also performs as an indicator for the centimeter scale. The bar is fastened to a maple block which slides along on two lengths of ⅛" drill rod which pass through the block.

The photograph on the cover shows a simplified setup which includes a 723 A/B klystron with its output probe protuding through its socket into rigid waveguide. Inserted into the source end of the guide is a variable position "short" which may be a brass plunger or piston fitted with spring contacts which is fitted into the end of the waveguide and is positioned with respect to the probe to give maximum output at the load end of the waveguide line.

Next to the oscillator is shown the indicating device previously described and connected to it is a short piece of rigid waveguide to which is soldered a coaxial fitting as shown, with a #18 copper wire probe protruding about ¼" to ⅜" down into the guide. The end of this same guide also may be" shorted," if standing waves of large magnitude are to be developed, or terminated in a matched load if it is desirable to cause smaller reflections in the guide, depending upon the amount of sensitivity of the measuring equipment and the amount of power available in the guide. A variable position "short" is shown in place, and a resistor termination is the dagger-like device shown resting on the stand. A coaxial cable is shown connecting the probe in the waveguide to the end of the Lecher wires along which standing waves will occur and from which approximate free space wavelength can be determined. The "shorting bar" across the bridge may be noted making contact with the #14 copper wire lines at the 9-cm point on the scale. Again it

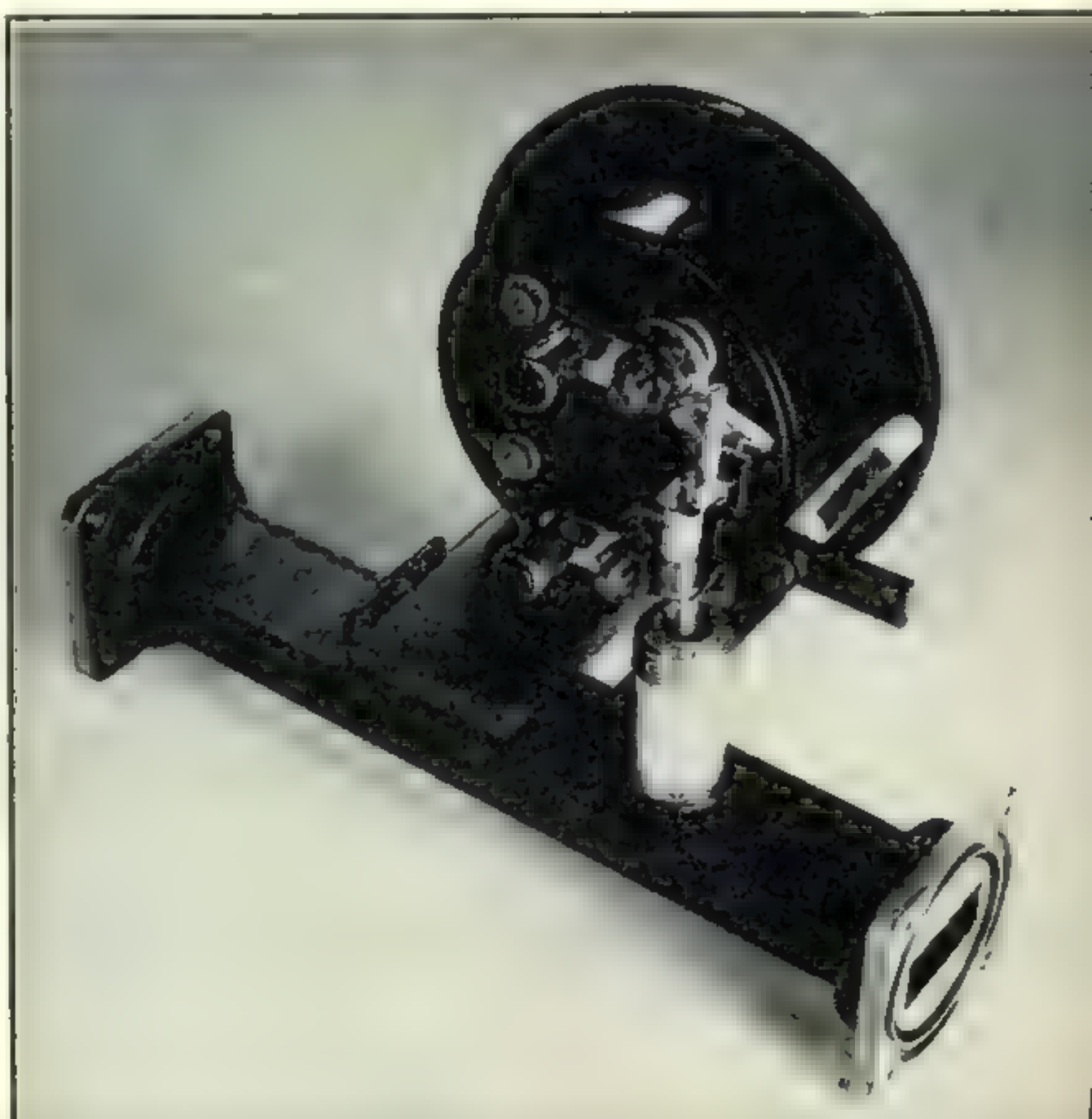


Fig. 3. Microammeter with crystal rectifier and probe mounted on 1 x 2 inch rigid waveguide.

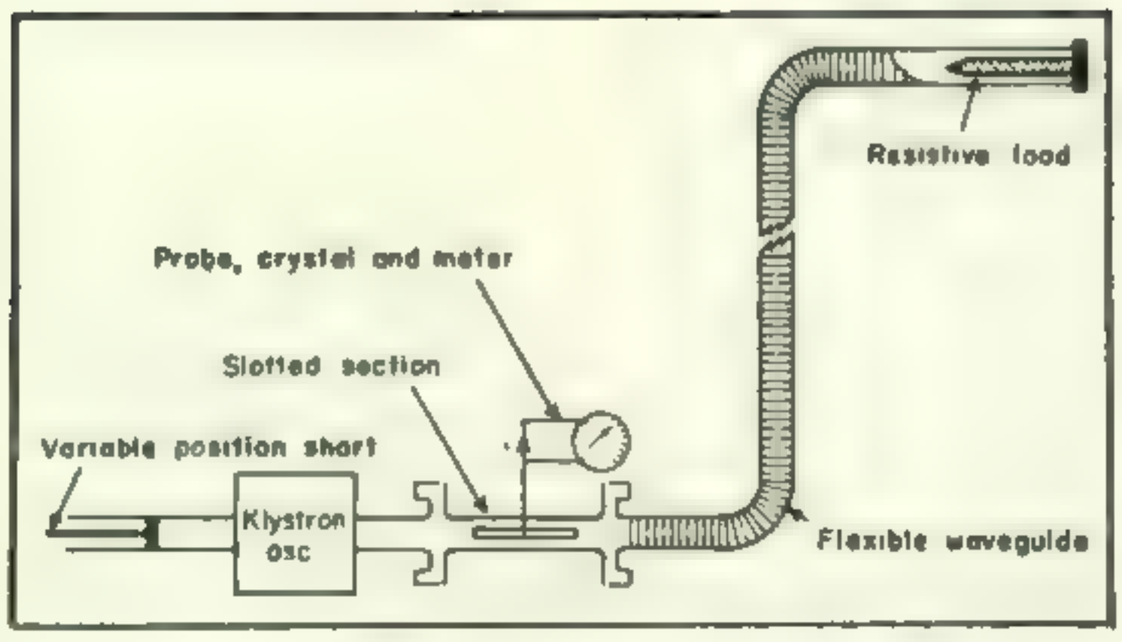


Fig. 5. This schematic indicates how a slotted waveguide section and field strength meter may be employed in a "traveling detector" arrangement. Flexible waveguide is terminated in its characteristic impedance with a resistive load.

should be stated that while this procedure has been used to get equipment working under conditions such as exist in locating a band, say 500 mc wide, it must be classified as a rough measurement. For more precise measurements certain other factors must be taken into consideration, such as placing a certain amount of "padding" or attenuation in the waveguide between the signal source and the load to reduce the amount of "pulling" of the oscillator. Attenuators for use with waveguides may be made by slotting a section of guide in the center of its wide dimension for about three inches or so and inserting into the slot a semi-circular piece of volume control resistance strip. The greater the area of strip inserted, the greater will be the attenuator introduced. The manner in which the strip is inserted presents curved or tapered edges to the wave motion in the guide and has a tendency to reduce reflections which are apt to occur whenever the plane inside surfaces are disturbed. The frequency of the klystron type oscillator depends somewhat on the load impedance and therefore changes in the load will be expected to shift the frequency of the signal source. To elaborate further, the frequency of the oscillator may change appreciably when the Lecher wire bridge and associated equipment is connected into or removed from the circuit, and certainly there is definite "pulling" or shifting of the oscillator's frequency as the wavelength measuring equipment is moved through resonance.

However, in the present stage of microwave techniques as they apply to the radio amateur, the use of buffer stages in connection with frequency measuring equipment, or the replacement of the measuring equipment with a similar load having identical impedance, is usually not feasible.

Once the oscillator has been adjusted for maximum output at the desired frequency, usually by adjusting the 723 A/B reflector voltage and tuning strut, the test gear may be removed from the line and the waveguide feeding the antenna can be attached.

Working with Flexible Waveguides

Flexible waveguides have been used with considerable success in runs from the r-f power source to the antenna, due to their ability to bend in both "E" and "H" planes and twist. Some claim difficulty in always remembering which "E" and "H" plane bends are, as they apply to waveguides. Those who have handled flexible waveguide know that they usually bend more easily in the flat or wide dimension than they do in the narrow or edgewise dimension. It is simple, therefore, to remember flexible waveguide elbows by "E" plane—for the *E*asy way in which the guide flexes and bends and "H" plane for the *H*ard way in which it flexes and bends. Elbows can be formed of flexible waveguide by hand when and where required and can be straightened out and relocated as changes in the system are made. At present, interlocked type of

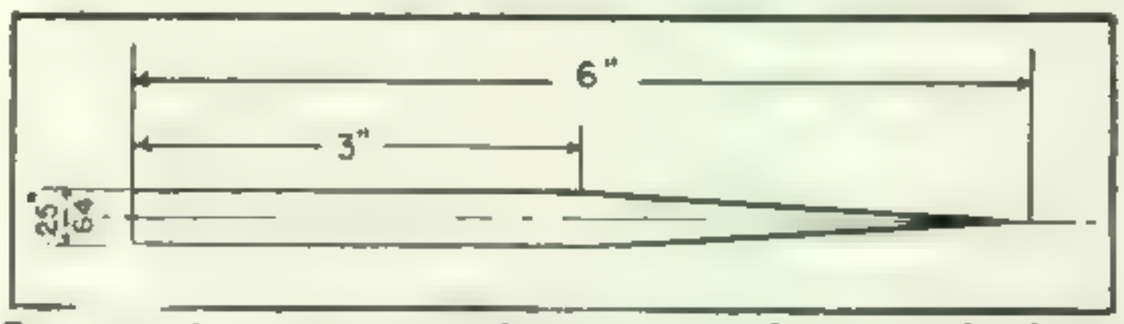


Fig. 4. Approximate dimensions of a matched resistance load for use with a flexible waveguide having inside dimensions of .400x.925 inches—for 3cm work.

flexible waveguides of tin coated bronze are being used for work of this kind. When it is desirable to install this type of guide in a manner that short runs are exposed to the weather, a simple form of moisture proofing may be obtained by wrapping the guide with one of several rubber or synthetic tapes. The rubber tape or "splicing compound" commonly used by electricians has been used. Of course, for maximum protection against the weather elements, a synthetic rubber jacket is molded on at the time of manufacture of the guide.

Matching the Waveguide Impedance

As usual, matching the waveguide to the antenna must be given due consideration and an impedance match which will reduce the standing wave ratio (S.W.R.) to as low an order as feasible is desired. A simple check on the matching problem may be made by inserting a short section of rigid waveguide (at point "X" *Fig. 1*) in which has been cut a slot in the center of the wide dimension of the guide. This slot will be wide enough to permit moving a

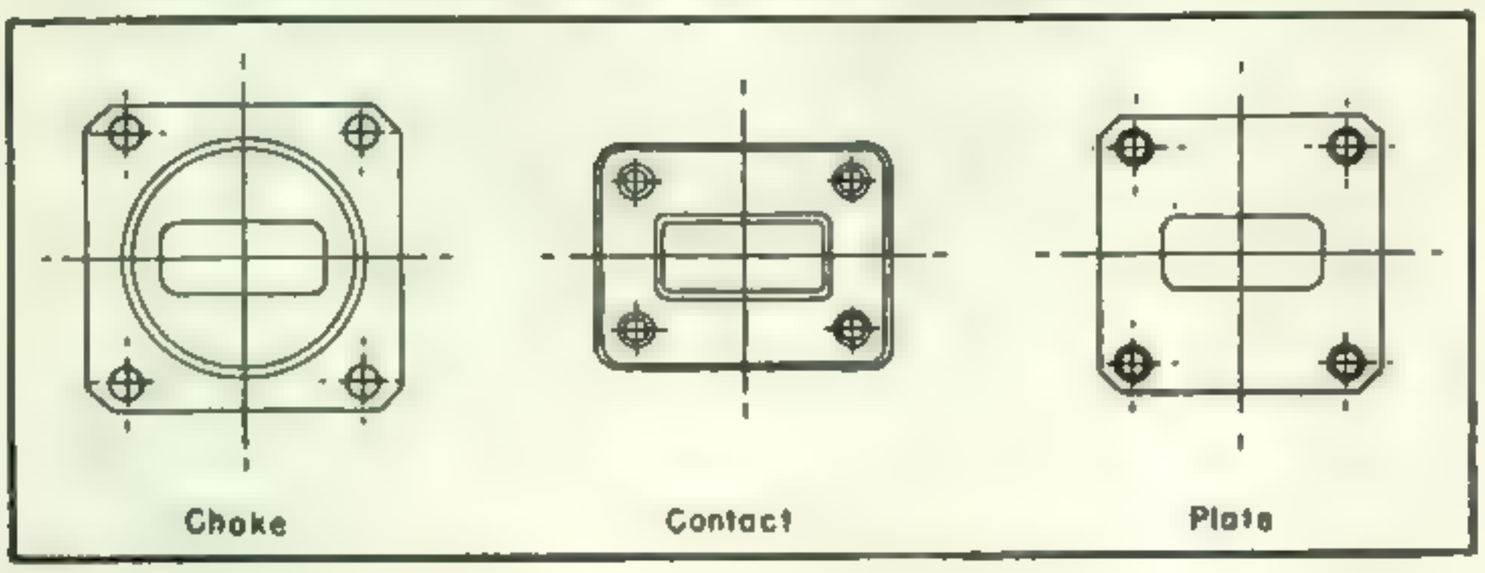


Fig. 6. Three types of flanges with which rigid and flexible waveguides may be fitted.

probe made of a short length of #18 copper wire along the center of the slot without touching the sides. This length of wire is fitted into the female coaxial fitting shown on the back of the crystal-meter combination in *Fig. 2* and is made long enough so that it can be inserted into the slotted waveguide for about 1/4". Thus as the probe, crystal and meter indicator are moved along the slotted section, one has in effect a simple "traveling detector," which is capable of indicating standing waves due to antenna mismatch. Obviously this arrangement is too crude to precisely determine S.W.R. but it provides useful information as adjustments to the antenna system are being made and shows whether the S.W.R. is being increased or decreased.

Voltage standing wave ratios (V.S.W.R.) of 5:1 for example, may be tolerated on transmission lines used at much lower frequencies, even some of those used in the v-h-f part of the spectrum. But such a degree of mismatch cannot be tolerated in waveguide techniques where one thinks of 1.5 : 1 as being rather high. When working with extremely low power one cannot afford to waste precious milliwatts by having it reflected back in the system instead of being propagated into free space.

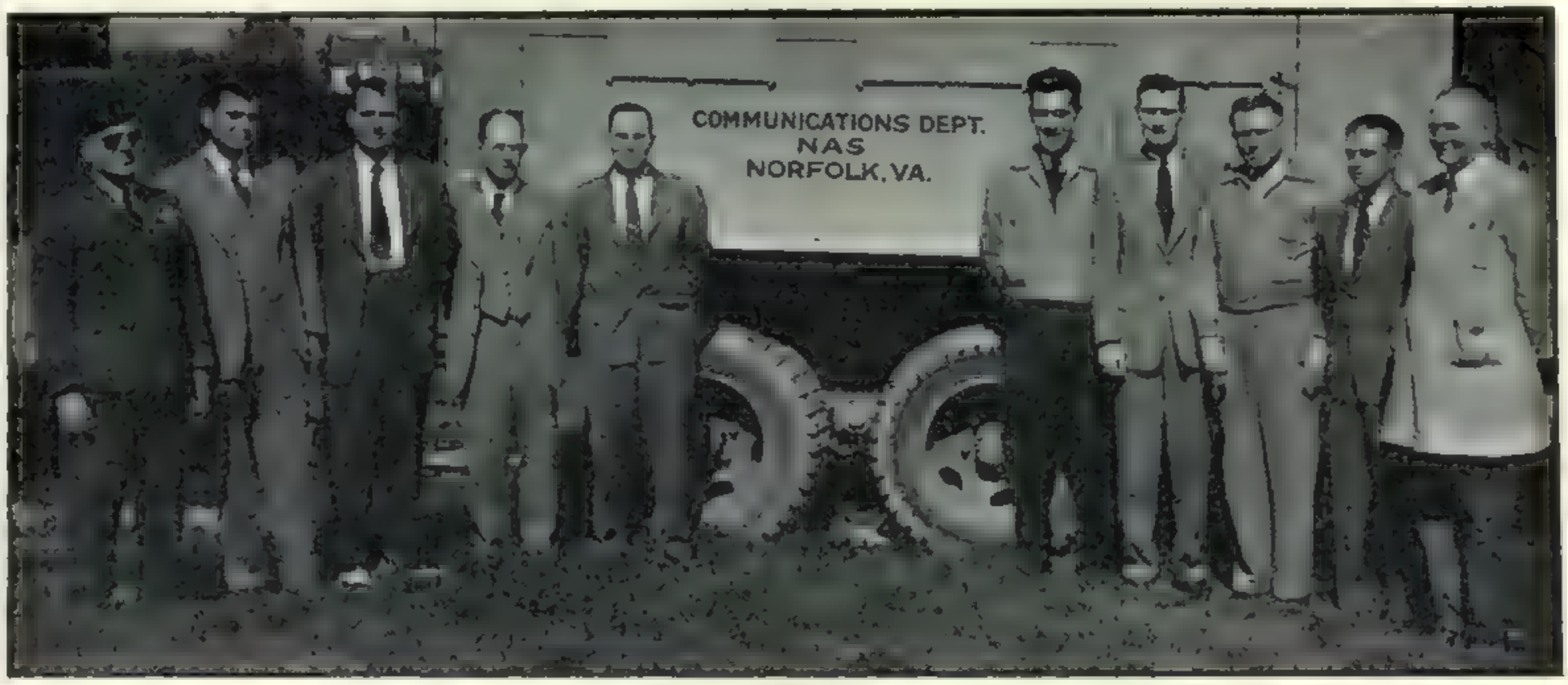
The type of oscillator which has been mentioned in connection with this gear, like most microwave oscillators, is very sensitive to changes in load impedance. A system with large reflections may have a low V.S.W.R. at one frequency, but a much higher one at a slightly different frequency. Consequently, the load on the tube may vary greatly with changes in frequency. If the degree of mismatch becomes too great it may pull the frequency seriously or even stall the oscillator at the frequency at which we desire to operate.

A simple means of indicating what the optimum adjustments might be is to disconnect the flexible waveguide from the antenna and insert into the guide a "matched" resistive load, which, for low power work may consist of a termination made of resistance strip as previously mentioned and shown on the cover. These loads may be designed so as to have a V.S.W.R. of *1.01 or lower*. Standing wave ratio measurements as described above, if made first with the resistive load and then with the complete antenna system connected, should give a good clue as to the degree of mismatch between the waveguide transmission line and the antenna. As a matter of fact, many of the preliminary adjustments or experiments may well be made with the waveguide transmission line terminated with such a resistive load, the low frequency equivalent of which we hams would call a "dummy load". Approximate dimensions for such a "matched" load are given in *Fig. 4*.

(Continued on page 97)

Norfolk Emergency Net

During the recent telephone emergency, hams of the Ocean View Amateur Radio Club in Norfolk, Va., at the request of Capt. C. Dillavou, U.S. Navy District Communications Officer, established an amateur station with the call W4LBG on the Norfolk Naval Air Station to handle emergency government communications, operating with nets on 3880 kc phone and 3510 kc c.w. Many stations and others nets were contacted throughout W. Va., Ohio, Md., N. Carolina and Va., with daily schedules from 1700 to 2300. In addition to those pictured at the NAS, the following amateurs volunteered their services: Siler, W4HPC; Rickey, W4FSO, Fraser, W4JFW; O'Heir, W4JMC; Turner, W4IVS; Stewart, W4DSK; White, W4OM; Kodar, W4BBC, and Vester, W4IQQ.



Part of the group of hams who volunteered their services at the Norfolk, Va., Naval Air Station during the telephone emergency. From left to right: Lt. Maloof, W4DOT, Communications Officer for the NAS; Perry, W4DHZ; Bishop, W4JSR; Deacon, no call; Roberson, W4BLU, Hoffman, W4KHK; Bohlander, W4LBP; Stephenson, no call; McWilliams, W4IQL; and Martin, W4JRH.

Life Insurance in the Shack!

GEORGE J. NICHOLS, M. D., W3JAY*

The Editors of CQ, in collaboration with Dr. G. J. Nichols, a cardiologist who has made a study of the sequelae of electric shock, present this article in the hope that increased knowledge may prevent accidents caused by electricity.

HISTORIANS OF THE FUTURE will probably say that the strategic interference in the return of an electric current to ground has marked man's achievement in electricity. When this interference has not been so strategic, and man himself has been the conductor, the result has been injury or death. Yet at the present day when we look around us, we find that electric shock as a part of our electrical training is disgracefully neglected. We are all aware of the tragic accidents which have happened to fellow radio amateurs. Many of these have been instances of carelessness, possibly born of an incomplete understanding of the dangers inherent in every electrical circuit. It is the purpose of this article to shed some light on the relationship of electric shock and the human organism.

The Causes of Death

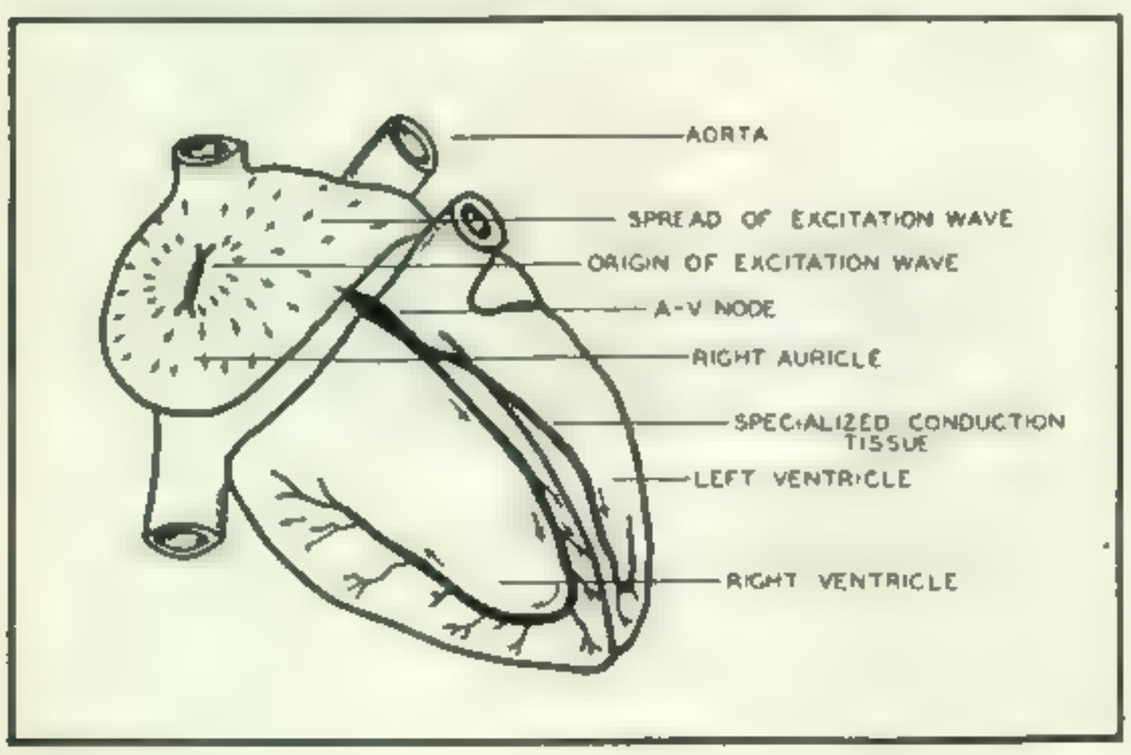
Two terms will be used frequently in this discussion which have intimate connections with the death-producing property of an electric current. They are: *ventricular fibrillation* and *respiratory center paralysis.* To understand and appreciate ventricular fibrillation it is necessary to have a brief understanding of the structure and operation of the human heart. A heart structure diagram is shown in *Fig. 1.* Normally, the stimulus for the heart to contract rhythmically is a minute electric current arising periodically in an area in the right auricle (sinus node). This minute electric current spreads over the entire auricle as an excitation wave and engages the specialized heart conduction system at the junction of the right auricle and right ventricle (A-V node). The stimulus then proceeds along and branches into the right and left bundles of the conducting system (Purkinje network) and reaches the arborized endings where it is transferred to the ventricular musculature causing them to contract. If this conduction system is paralyzed the heart muscles may respond in a haphazard fashion, the effect being a quivering and discordant contraction, making the ventricles incapable of supplying the oxygenated blood to the rest of the body. This purposeless muscle activity is called ventricular fibrillation. The occurrence of ventricular fibrillation in man usually causes death, as recovery from this phenomenon has been recorded only in very rare instances.

The second most lethal effect of an electric current on the human organism is respiratory center paralysis. Normal respiration is governed by a respiratory center located in the medulla oblongata portion of the hind brain. It is here that the stimulus to breathe day in and day out, year after year without cessation, arises and is sent over a complex nerve network to the breathing muscles and the lungs. Naturally, anything interfering with the function of such an important regulating mechanism, directly or reflexly as in the case of an electric shock, is life-endangering. Death from electric shock may be caused by either of these two effects or by a combination of both.

All investigators agree that there are certain governing factors which influence the injurious effects of electricity on the human body. They are: current, voltage, body resistance and duration of contact, type of current, path of the current and susceptibility of the organism at the time of contact. It is impossible to select any one of these factors and say that it is entirely responsible for the injurious effects. It must be remembered that all factors operate simultaneously and one factor is interdependent on all others. Voltage itself does not cause death, but requires the flow of current which is, of course, determined by the resistance that varies with the circumstances of each individual contact with the charged conductors.

Amperage is the most important single factor in determining the over-all effects of an electric shock. Skin resistance at the point of contact and voltage

*5410 Wayne Ave., Philadelphia 44, Pa.



The rhythmic heart beat is controlled by a minute electric current generated in the right auricle. The current spreads over the auricle and flows into the specialized conduction system to the main pumping chambers—the ventricles. Any other electric current interfering with the minute heart current may produce deadly ventricular fibrillation if sufficiently strong.

Emergency Treatment for Electric Shock

1. **Turn off power. Pull victim by his clothes clear of equipment!**
2. **Start to apply artificial respiration at once—seconds count!**
3. **Obtain assistance by shouting, but do not stop artificial respiration for any reason until arrival of a physician!**

Fig. 1

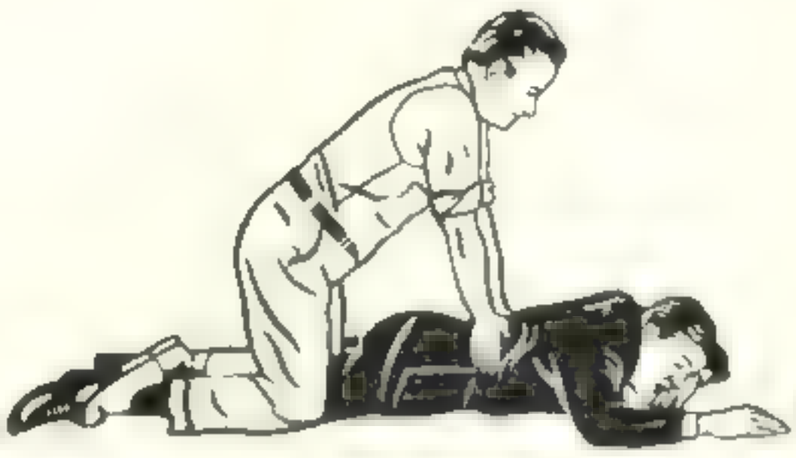


Fig. 2

Fig. 3

Method of Giving Artificial Respiration

1. Lay the victim on his belly, one arm extended directly overhead, the other arm bent at elbow, and with the face turned outward and resting on hand or forearm, so that the nose and mouth are free for breathing. (See Fig. 1).

2. Kneel straddling the victim's thighs, with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Fig. 1.

Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position and the tips of the fingers just out of sight. (See Fig. 1).

3. With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the victim. The shoulders should be directly over the heel of the hand at the end of the forward swing. (See Fig. 2). Do not bend your elbows. This operation should take about two seconds.

4. Now immediately swing backward, so as to remove the pressure completely. (See Fig. 3).

5. After two seconds, swing forward again. Repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

6. Continue artificial respiration without interruption until natural breathing is restored, or until a physician pronounces the victim dead.

7. As soon as artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the victim's neck, chest, or waist. Keep the victim warm. Do not attempt to give anything by mouth until the victim is fully conscious.

8. To avoid strain on the heart when the victim revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the victim has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in half a glass of water or drink of hot coffee or tea, etc. The victim should be kept warm.

Prepared from material supplied by the American Red Cross and the Metropolitan Life Insurance Co

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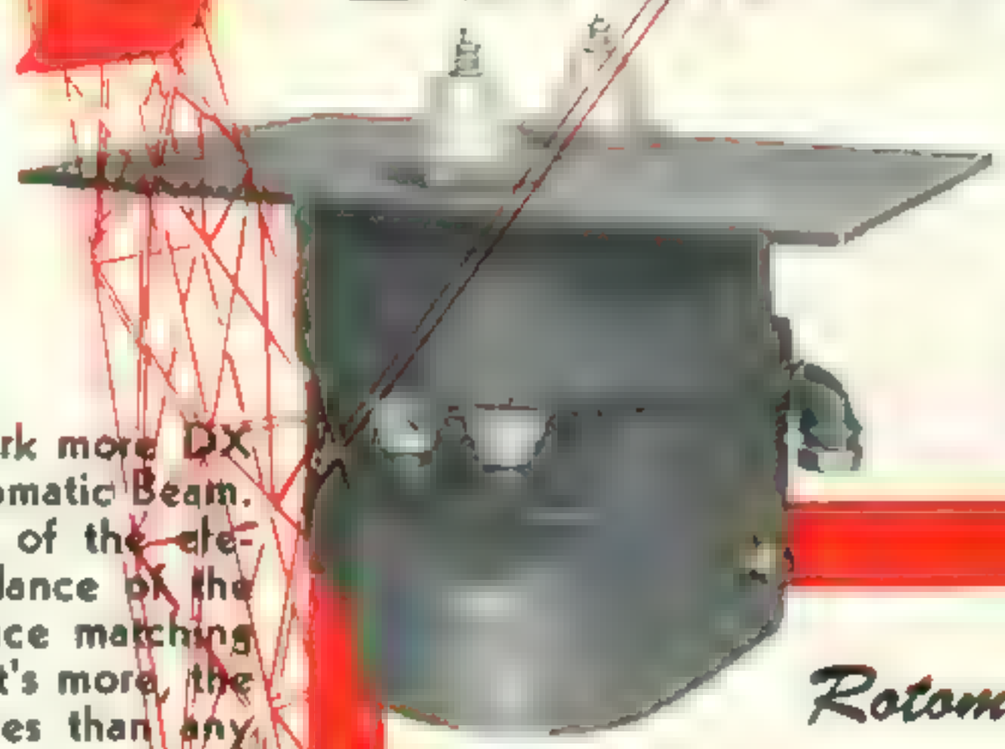
JOHNSON

Rotomatic

BEAM ANTENNA



Heavy-duty drive unit is self-lubricating and fully enclosed.

You'll have more QSOs, work more DX with the new JOHNSON Rotomatic Beam.

Because of the construction of the elements, which match the impedance of the open wire line, exact impedance matching is possible on two bands. What's more, the open wire line has lower losses than any other method of feed.

In spite of the JOHNSON Rotomatic's tremendous increase in directivity and gain, and resultant front to back ratio, it possesses such broad band characteristics that it can be used over a wide range of frequencies. That old bug-a-boo, sagging of the elements, is entirely eliminated by a special alloy tubing.

The drive unit is really heavy-duty—providing rotation through 360° at 1½ RPM. May be purchased without motor for hand drive. The combined direction indicator, with great circle map and beam control, is a marvel of operating efficiency—where speed counts as never before.

New direction indicator and beam control is Selsyn motor operated.

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The entire unit is so strong and light that it will withstand heavy icing and extremely high winds. Adjustable elements that are permanently sealed against corrosion with a tough, clear plastic for efficient radiation.

Two band operation with Deluxe model. Two arrays fed with same transmission line, switched by low-loss RF relay.

Receive better, too! Selective receiving reduces interfering signals.

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New matching system permits efficient wide band operation and freedom to move about from the low to the high end of the bands. In addition, the open wire line results in the lowest losses possible.

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Powerful, smooth rotation through 360° at 1½ RPM.

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Selsyn motor controlled indicator. Indicating arrow glides through 360°, in either direction, under great circle map of world etched on convex dial face. Stop beam anywhere instantly.

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may be at wide variance and different in each case, but the intensity of current and the path it takes through the body are the criteria for judging injurious effects.

Alexander[1] gives us an idea of what the intensities of an electric current must be to produce the so-called shock. He states that, " . . . an electric current of 0.2 to 0.3 ma is felt by humans as a *tap*, one of 0.75 ma as a *pinch*, a current of 1.0 ma as a *grip*, one of 5.0 to 15.0 ma causes unpleasant stimulation of the muscles, one of 15.0 to 19.0 ma and above stimulates and at the same time paralyzes, or rather blocks for voluntary action the muscles and nerves through which it flows for the duration of the contact, one of 25.0 ma and above may produce permanent damage especially to nerve tissues and blood vessels, and one of 70.0 to 90.0 ma and above may be fatal."

From the above statements we can also see why it is believed by some that a charged conductor has the power of "drawing" or holding its victim, or that in some instances the victim is believed to be "thrown" away from the conductors. Actually, of course, this is not the case. When the current flowing through the muscles and nerves is sufficiently strong (above 15 ma) it causes a contraction of muscles and paralysis of the nerves involved, and thus it is impossible for the victim to "let go" because he has no control over these muscles during the time which the current passes. If a sufficiently large number of muscles are stimulated by the electric shock, the sudden violent contraction of the muscles produces a "throwing" or "knocking" effect. This is secondary to muscle stimulation, not a property of the charged conductor. Therefore, the victim actually throws himself which may cause serious and painful injuries.

It is evident that the amperage required to cause death need not be very high. As a matter of fact, a current flow of 70 ma at the ridiculous low value of 25 volts if passed directly through the chest is capable of causing death due to ventricular fibrillation. Higher current values (1 to 6 amps) do not appear to have the tendency to produce ventricular fibrillation when passing through the heart. Higher currents cause a sustained violent contraction of all musculature including the heart. As mentioned before, ventricular fibrillation is a chaotic and purposeless contraction of heart muscles. If the current is of sufficient strength, the heart muscles are thrown into a state of complete contraction, thus preventing the phenomenon of fibrillation from occurring. Provided the victim is released from the shocking source within a short time (3 to 4 minutes at the very most), the inherent irritability property of the heart muscles may cause it to resume normal rhythmic contractions, particularly if the heart is

The two principal positions in the prone pressure method of applying artificial respiration. The top photo shows the correct position immediately before applying pressure, which is applied by swinging up and forward, as indicated in the bottom photo. Step-by-step instructions are detailed on the special insert.

stimulated by artificial respiration (or directly by cardiac massage).*

The Factor of Voltage

In certain selected cases the optimum lethal current value of 70 to 90 ma may be higher than necessary to indirectly cause death. That is, if a current of the magnitude of 15 to 20 ma passes from hand to hand through the chest, the victim is incapable of releasing himself from the circuit. Furthermore, the path of the current may cause the muscles of the diaphram to be stimulated to contraction. The continued spasm or contraction of the diaphram muscles and the victim's inability to "let go" can cause death from asphyxia even though the heart or the respiratory center may not be seriously involved.

Inasmuch as a considerable amount of data has been accumulated using voltage as the criterium of judgment in electric shock cases, it might be well

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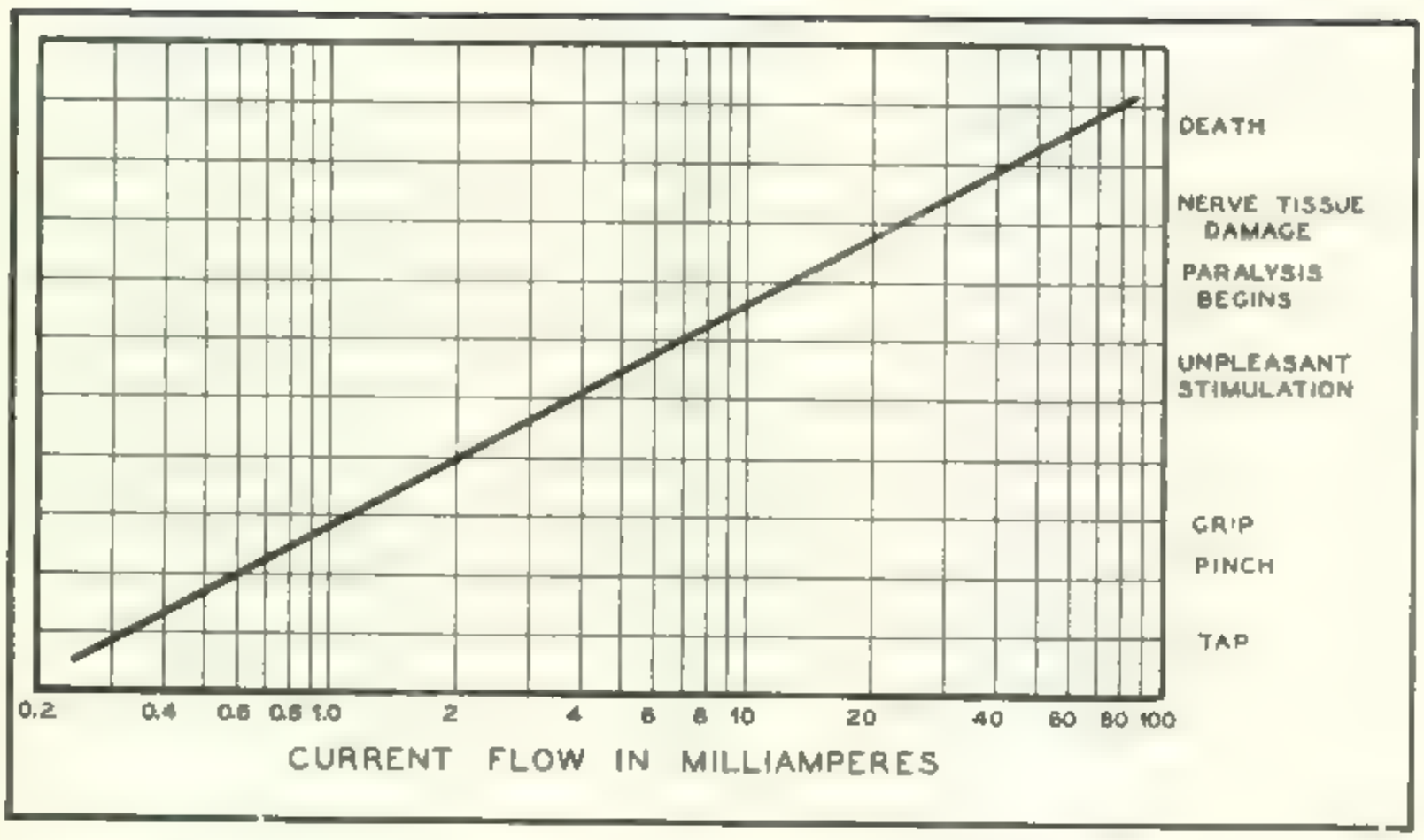
*Ventricular fibrillation also occurs in patients undergoing surgical operations. Beck ("Diagnosis and Treatment of Cardiovascular Diseases," Vol. 2, 1940, pp. 1181-2) has discussed an operation where fibrillation was stopped by subjecting the heart muscle to a shocking current of about 1.5 amps for a very short time, thus causing sudden total contraction of all heart muscle. This electric shock and sudden contraction stopped the fibrillation of the heart muscle.



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The flow of the electric current through the body may be recognized by certain physical sensations. Note the sequence of the physical effects with the increase in current. Death generally occurs from ventricular fibrillation between 70 and 90 milliamperes.

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to discuss this factor. We must, however, continue to bear in mind that the combination of voltage and skin resistance produces the all important current flow through the body.

The question always arises—how many volts will kill me? Upon examination of medical records it was found that there were cases in which death was attributed to the relatively low voltage of 45 to 60 volts. Naturally, all other factors have been optimum. But even so, it is worthy of consideration, from a medical viewpoint many authorities regard any potential above 25 volts as dangerous to human life.

With changes in the voltage level, there appears to be a change in the manner in which electricity causes death. At the ordinary house current frequency of 60 cycles, charged conductors carrying voltages below 220 volts are considered extremely dangerous since they tend to produce the deadly ventricular fibrillation phenomenon in the heart. Contact with conductors carrying 220 to 1000 volts is especially dangerous since in addition to producing ventricular fibrillation there is also a tendency to produce respiratory center paralysis in the brain, a combination which materially lessens chances of recovery.

Pearl,[3] in discussing effects of voltages above 1000, cites a series of cases in which the recovery rate of victims rendered unconscious by electrocution was 62%. When the victim was rendered unconscious by exposure to much lower voltages the recovery rate was only 39%. From these and many similar recorded data it can be safely presumed that shock produced by contact with voltages in excess of 1000 tend to produce respiratory center paralysis alone. This is probably due to the same reasoning as given under the discussion of amperage, whereby the heart muscles go into a state of complete contraction (precluding ventricular fibrillation) due to the excessive current flow. Voltages below 1000, and especially those common to household distribution, cause fibrillation and proportionally greater number of deaths.

Within recent years some authors have advanced the theory that there is a substantial additional e.m.f. produced in the body tissue by the interruption of the flow of the shocking electric current. This has given rise to the erroneous conception that the interruption of an electric current flowing through the human body can produce a state of ventricular fibrillation in a heart, not otherwise undergoing this phenomenon. This has been called counter-shock. Conversely, they maintain that a heart exhibiting fibrillation can be jolted back to normal rhythm by this means. However, this suggestion violates elementary electrical laws since in order to produce a transient induced e.m.f. in the body tissue we must have considerable inductance. The inductance of the human body is far too small to be capable of producing the appreciable e.m.f. needed to cause fibrillation.

Skin Resistance and Duration of Contact

Skin resistance is an extremely variable but important factor in considering the injurious effects of an electric current. It is the first barrier of defense of the human organism. Bone, muscle, and nerve tissue are comparatively much lower in resistance than the skin. Consequently, the skin becomes the limiting resistance in the passage of an electric current through the body. Skin resistance may vary from one megohm in the case of a calloused dry hand to 300 ohms in the instance of skin wet with saline perspiration. The average resistance is about 5000 ohms.

The duration of contact is intimately related to skin resistance since as contact time increases the skin resistance rapidly decreases. This is most likely due to the stimulation of sweat glands which produces greater perfectness of contact.

By application of Ohm's Law it can be seen why a potential of 30 volts can cause a lethal current of 70 ma to pass through the body. When we consider that the potential of 110 volts is most frequently contacted it can easily reach a dangerous level of 100 ma in passage through the chest when the skin resistance is as high as 100,000 ohms. The initial burning of the flesh at the point of contact and exit will also cause carbonization of the tissue and reduce the skin resistance to a very low value. Skin resistance can be easily measured with an ohmmeter. When the occasion arises again for you to use this instrument it will prove interesting to note the variation of resistance from hand to hand and from different degrees of pressure on the electrodes. Also note the very appreciable reduction in skin resistance obtained when the contact areas are moistened.

Path of Current

The path which an electric current traverses the human body is largely responsible for its injurious effects. For all practical purposes, the human body can be considered a heterogeneous conductor of electricity, there being very little difference in the conductivity of bone, nerve, muscle or blood tissue. Furthermore, the path of the current is the most direct one from the point of contact to the point of exit. The current does not, as is generally believed, follow the so-called "salty" blood stream. Any pathway involving the heart or brain is considered dangerous. Head to left leg is particularly dangerous since it involves both the brain and the heart. Arm to arm and arm to leg and chest contacts bring the heart into the path, consequently at low current levels causing ventricular fibrillation from abnormal stimulation of the heart. Except for secondary tissue damage, leg to leg contacts are not particularly dangerous since no vital organs are traversed by this route.

Schudde[3] reports an interesting series of post mortem examinations on persons killed by contact with circuits carrying a voltage not greater than 250. He found burns of the *left hand* in 90% of these victims. Remember that little rule of keeping one hand in the pocket while working on the rig?—try to make sure it is the *left hand*. Of course, a good ground predisposes to accidents. A damp concrete cellar floor with damp shoes and a myriad of shoe nails to help make contact more sure is a combination of circumstances to which many experimenters are constantly exposed. It is significant when one reads accounts of electrical accidents that in many instances a concrete floor is mentioned. The account of the electrocution of Philip Murray (W9VYU, Dec. 7, 1938) suggests a concrete floor and even mentioned a small puddle of water. It definitely behooves anyone working around electricity to have an insulated platform of flooring or dry wood. Rubber mats are not always safe, since some rubber products have an appreciable lamp black content, which is a fairly good conductor.

Susceptibility to Electric Shock

There are a number of less important factors which can influence the effect of an electric current. Perhaps the one which might concern us most is fatigue. Aiello[4] points out that fatigue increases the susceptibility of the body to electricity. Statistics have confirmed the fact that the greater number of accidental electrocutions have occurred during periods of maximum fatigue. Many of us attempt to construct and repair our apparatus during the time of maximum fatigue. In itself, it may not be a dangerous procedure, but couple it with the lack of precaution, exposed wiring, high voltages and, what is worse, haste with its consequent tendency towards carelessness and we have a serious threat to human life. Otherwise, however, it is difficult to prove from available data and the results of electrical experiments that pre-existing diseases or conditions of the body increase the susceptibility to electrocution.

As to the type of current, it has been found that a.c. at ordinary household frequencies (25-150 cycles) is roughly three times more dangerous than a d.c. of the same potential. However, Pearl[2] states that d.c. is capable of producing a much more intense nervous inhibition and tends to produce ventricular fibrillation in a much shorter time. When all factors are considered, it probably matters little whether a.c. at the household frequencies or d.c. is the shocking source—the over-all effects being about equal.

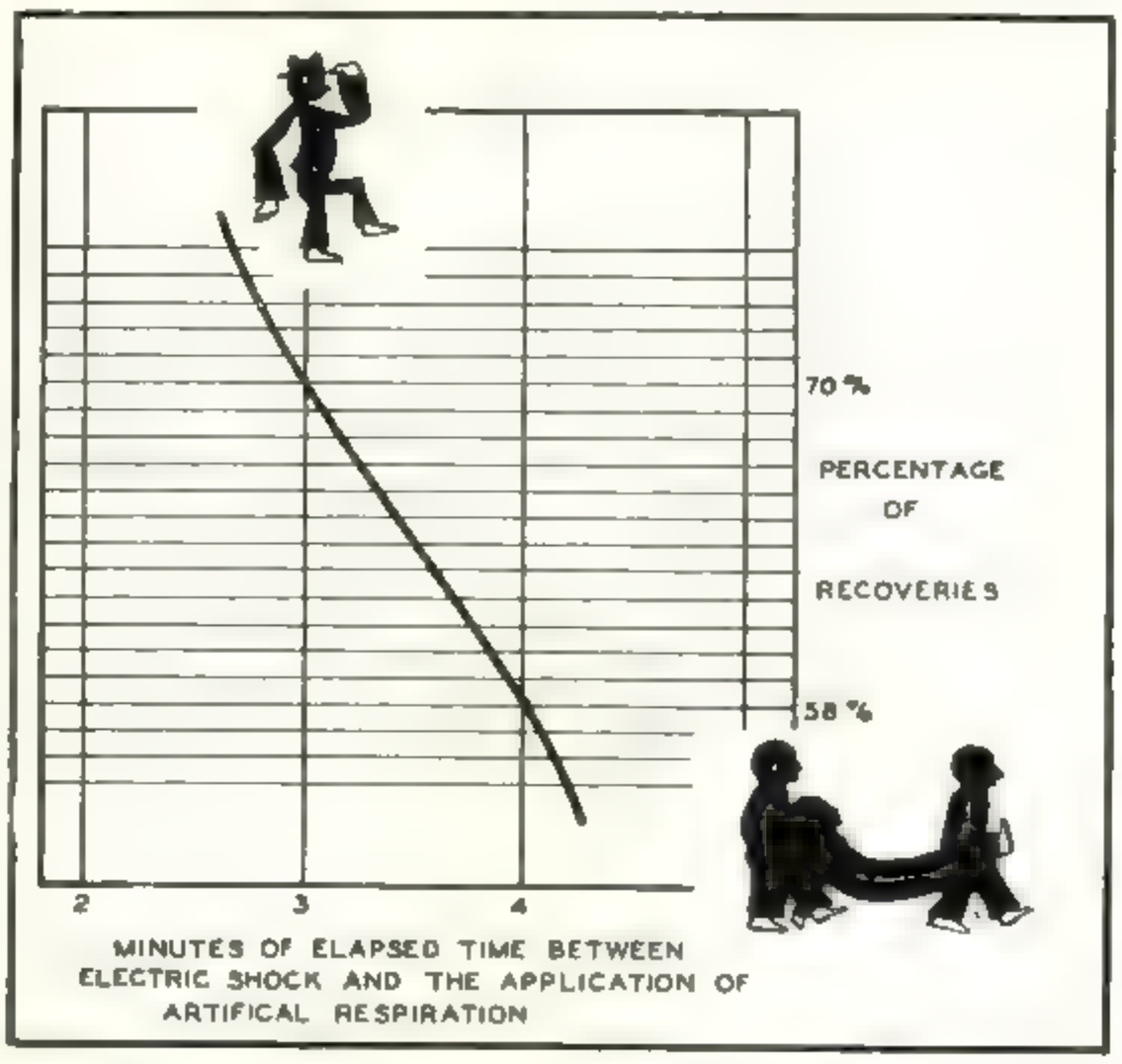
As the frequency of an a-c current increases the injurious effects decrease. Animal hearts subjected to an a-c current were found to be much more sensitive to lower frequencies. For instance, a dog's heart was found to be 20 times more sensitive to an a-c current of 150 cycles than to one of 1750 cycles. When alternating currents reach the radio frequency level (0.01-29.0 mc) the currents, even though they may be of the magnitude of several amperes, produce no muscle or nerve stimulation, the effect being one of heat. This is the principle involved in all medical diathermy machines. Increasing the current further produces destruction of living tissue by burning, this being the process akin to the "electric-knife."

Caution must be exercised in the use of diathermy machines by the laity since the heating effect takes place through the entire tissue. While the skin nerves are able to distinguish between "hot" and "cold" the central nerve tissues or body organs may be unknowingly injured by excessive heating.

Delayed Effects of Electric Shock

The fact that we survive after contact with electricity does not always preclude escape from injury. There are certain effects which an electric current is capable of producing in the human body as an aftermath of the electric shock. The knowledge

(*Continued on page 92*)



In an examination of some 600 cases of accidental electrocution, MacLachlan found that the averaged elapsed time between the shock and the application of artificial respiration was the determining factor in recoveries. When applied in less than 3 minutes after the shock the recovery was 70%. When applied in less than 4 minutes the recovery was only 58%. Death generally occurs in the absence of heart and respiratory action within 5 or 6 minutes.

The L Network as An Impedance Transformer

F. D. WELLS, W6QUC*

THE USE OF COMBINATIONS of L and C for impedance matching is well known, and many excellent articles have been written on this subject. For the greater part, these articles have treated the subject on a mathematical basis with little regard for the manipulations necessary to put information in a practical form.

It is the purpose of this article to present the amateur with a simple, yet versatile, matching network stripped of all mathematics, and to give data that will enable him to match feed lines to 2, 3 and 4-element beams. Many clever and interesting methods have been presented for solving this problem, but as far as we can determine the "L" network has been largely overlooked in amateur literature. The proposed circuit takes advantage of the characteristics of a simple tank circuit.

Fig. 1a shows a parallel tuned circuit. If it is tuned to resonance, the impedance that appears at terminals *D* and *E* is a pure resistance at the resonant frequency whose value depends on the "Q" of the circuit and the reactance of the condenser or inductance at the resonant frequency. Since the losses in the condenser are negligible for the frequencies we are going to discuss, this is tantamount to saying that it is a function of the Q of the inductance. If for a certain value of L and C the Q is high (a-c coil resistance low), the terminal impedance will be high. If the Q is low (a-c coil resistance high), the terminal impedance will be low.

Normally the a-c resistance of a well designed inductance is quite low, but suppose that we open the circuit as shown in *Fig. 1b* and intentionally introduce resistance at *HJ*. As more and more resistance is introduced, the impedance at terminals *F* and *G* becomes less and less, and if a source of fixed r-f voltage is applied to these terminals, more and more power will be drawn from the source. An excellent example of this that every amateur has experienced is the action of an unloaded Class C amplifier. If the unloaded tank circuit Q is not too high, the plate current dip at resonance will not be very great, showing that power is being drawn from the amplifier and being absorbed by the tank circuit. By using heavier wire in the coil and securely soldering connections to reduce the a-c resistance in series with the tank circuit, a lower dip usually can be achieved, which indicates a higher impedance circuit with less power being furnished by the amplifier. This further illustrates a very important point— *a relatively small amount of resistance in series with a parallel tuned circuit will produce a radical change in the impedance at its terminals.* From the foregoing it can be perceived that a tank circuit has a very valuable property: *Power can be absorbed by a low resistance in series with the circuit, and can be delivered to the circuit at a high impedance across its terminals.* Of course, in actual practice, a resistance would not be used at the output terminals *H* and *J* in *Fig. 1b*. Instead, the radiation resistance of an antenna would be connected at this point.

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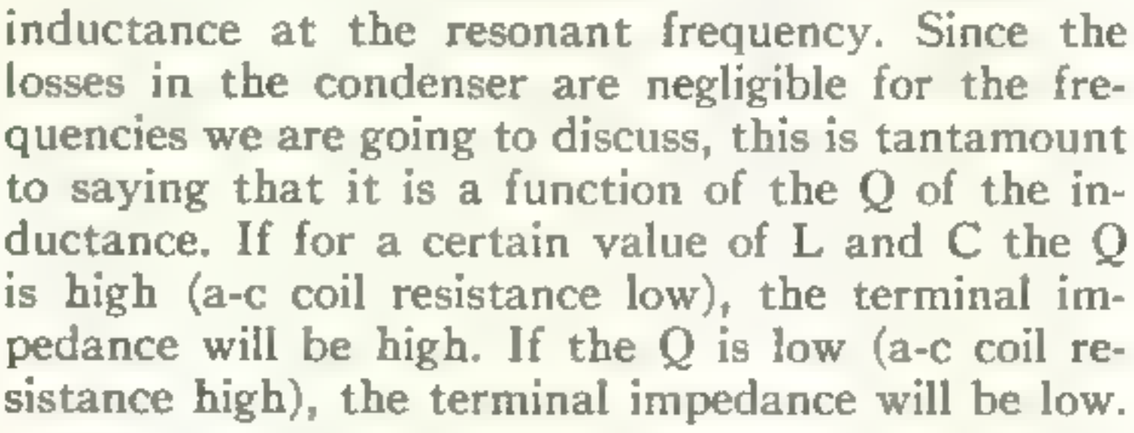


Fig. 1. The development of a parallel-tuned circuit into the basic L network, as explained in the text.

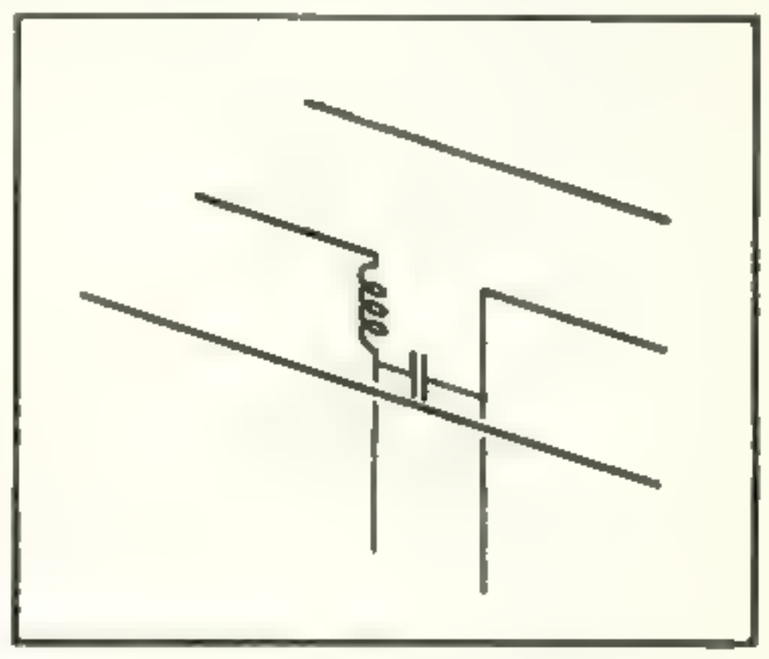


Fig. 2. L network used to match a feed line to a 3-element beam.

Versatility of the L Network

Fig. 2 shows the network being used to match a feed line to a 3-element beam. The constants are so chosen that the input terminals of the network present an impedance that matches the line when the low radiation resistance of a beam antenna is connected to the output. The calculations are a bit tedious, hence tables have been prepared giving the coil turns and diameter, and the capacity necessary to match the commonly used feed lines to close-spaced arrays. It will be noted that the values of inductive and capacitive reactance, as well as the inductance in microhenries, are given for those who wish to check the operation of the equations which are printed in the appendix.

For purposes of calculation, it was assumed the feeding impedance of 2, 3 and 4-element close-spaced beams is fifteen, eight, and five ohms, respectively. If the beam spacing, tubing diameter and tuning are such that the antenna does not meet these specifications, pruning of the inductance and retuning the condenser may be necessary to produce a "flat" feed-line. This ability to alter the constants slightly to achieve an exact match should make the "L" network particularly attractive to the amateur.

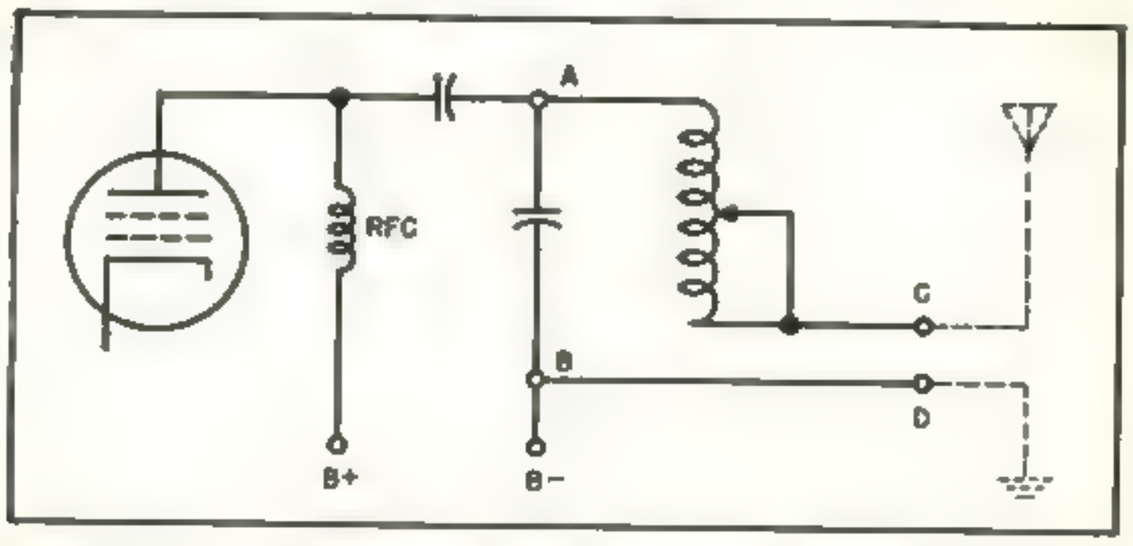


Fig. 3. The L network used to match antenna wire to a Class C amplifier. The values as discussed in the text are fully developed in Table 3.

The network should be located as close to the center of the radiator as is mechanically possible, and should be in some sort of water-proof enclosure. This need not be very large, since the components are not bulky. The peak voltage that will occur across the condenser when 500 watts of unmodulated r-f is fed to the network is shown in *Table 1*. From this it can be seen that relatively close plate spacing can be used.

Practical Illustrations

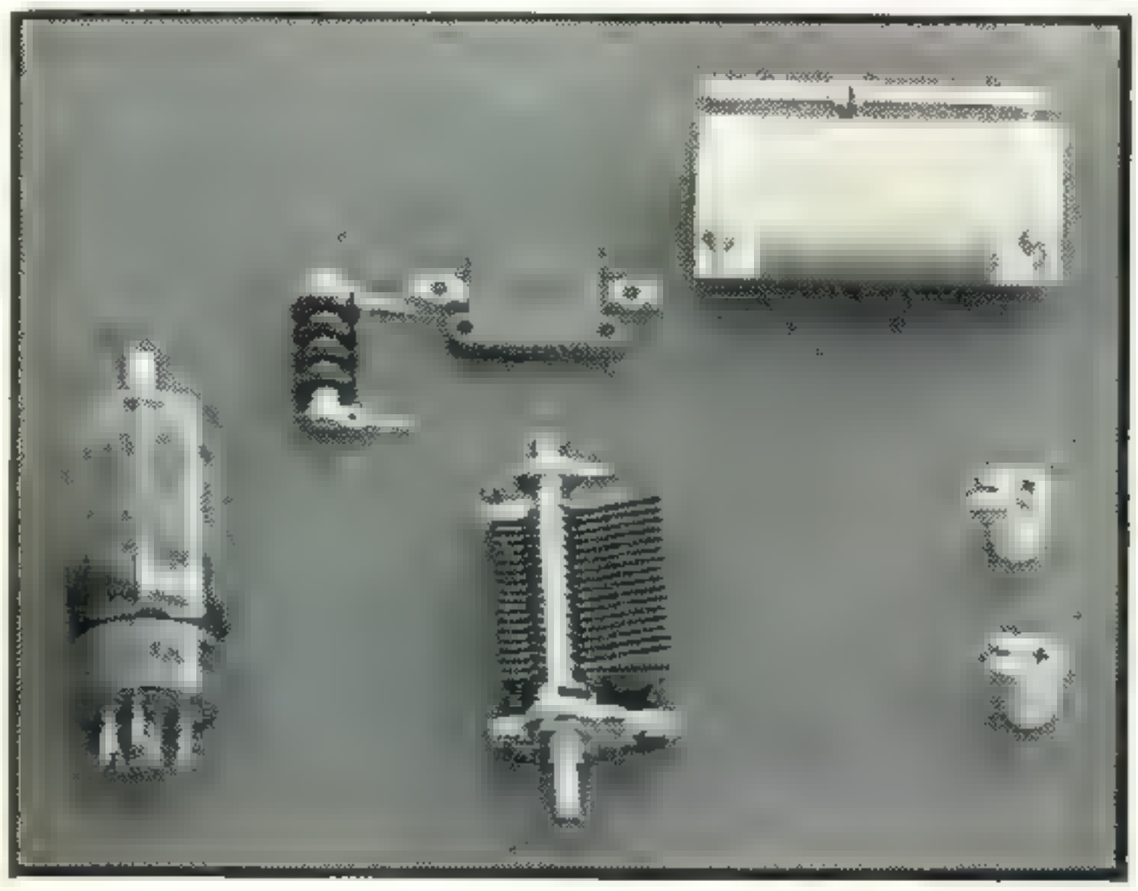
As an example, suppose that a 3-element close spaced beam is to be fed with 600-ohm open-wire line on 29 mc. The theoretical impedance of the beam is about 8 ohms. In the bottom half of the 29-mc table find in the column marked "MATCH" the line "600 to 8." The third column gives the capacity as 79 $\mu\mu$f; the last three columns give the coil data. A self-supporting coil of heavy wire should be wound on a one-inch diameter having six turns and so spaced that the length is 1¼ inches. If the exact operating frequency is other than 29 mc, the same trial values of capacity and inductance should be used, since an adjustment will be made after the beam is tuned.

When tuning the beam elements, check the network condenser for correct capacity by noting the response in the field-strength meter, or by using a loop-light loosely coupled to the network inductance. This should be repeated after each adjustment of the radiator.

After all elements have been tuned and locked, check the feed lines for standing waves. If the line is "flat," you have had an unprecedented bit of luck. Let us suppose a thermocouple galvanometer is to be used to check for standing waves. If the current decreases as the network is approached, the impedance presented to the line by the network is too high. Under these circumstances the inductance in the matching network should be reduced and the capacity increased. This could be inferred from looking at the table, which shows that 110 $\mu\mu$f are needed to match 8 to 300 ohms, and only 29 $\mu\mu$f to match 8 to 600 ohms. It will also be noticed that the capacity and inductance of the network almost form a resonant circuit at the operating frequency, particularly if the transformation ratio is high. If XC equaled XL, the circuit would be resonant; but in each case, the values are slightly different. The capacity is always somewhat less than that required to tune the inductance to resonance at the operating frequency. Before the network is installed at the antenna, it should be connected as a parallel tuned circuit and *loosely* coupled to the transmitter tank circuit to determine the setting of the condenser for which it resonates. When properly operating at the antenna, a slightly lesser value of capacity should be necessary, and this value should closely match that given in the table.[1]

Fig. 3 shows another application of the matching

[1]It should be clearly understood that Tables 1 and 2 are based on R (the impedance of the driven element at the feed point) being purely resistive. To insure that this is the case, the feed line should be connected to the driven element at the normal feed point with the L-C matching network completely removed. For the case of close-spaced arrays with half-wave elements the resistive term of the impedance of the driven element at the feed point will be less than the characteristic impedance of the feed line. Hence when the impedance of the driven element is purely resistive, a current maximum will occur at the feed point. Couple the feeders to the final tank circuit, and excite the array. Lengthen or shorten the driven element until the current maximum is at the feed point. If the current maximum is on the antenna side of the feed point, the driven element is too long. If current maximum is on feeder side of feed point, the driven element is too short. The adjustment of the length of the driven element to present a resistive impedance at the feed point must be performed after the parasitic elements have been adjusted to their final length, since the parasitic elements reflect a reactance into the driven element that varies as a function of the length of the parasitic element.



The components of the basic L network, as compared to a 2E25, enable the construction of a compact and highly versatile tuning unit.

Table 1—14,250 kc

Match	XC (Ohms)	Cap. ($\mu\mu$f)	Peak Voltage	XL (Ohms)	Inductance (μh)	Diam. (Inches)	Length (Inches)	Turns
600 to 15	96.2	116	770	93.6	1.045	1 5/8	1 1/2	6
600 to 8	69.8	160	770	68.8	.768	1 3/8	1 1/2	6
600 to 5	55.0	203	770	54.5	.608	1 1/2	1 1/2	5
300 to 15	68.8	162.5	540	65.4	.73	1 1/4	1 1/2	6
300 to 8	49.7	224	540	48.3	.539	1	1 1/4	6
300 to 5	39.1	286	540	38.4	.428	1	1	5
72 to 15	37.0	302	270	29.2	.326	1	1 1/4	5
72 to 8	25.5	438	270	22.6	.252	1	1	4
72 to 5	19.7	567	270	18.3	.204	7/8	1	4
50 to 15	32.8	341	220	22.9	.256	1	1	4
50 to 8	21.9	510	220	18.3	.204	7/8	1	4
50 to 5	16.7	669	220	15.0	.168	3/4	1	4

Table 2—29,000 kc

Match	XC (Ohms)	Cap. ($\mu\mu$f)	Peak Voltage	XL (Ohms)	Inductance (μh)	Diam. (Inches)	Length (Inches)	Turns
600 to 15	96.2	57	770	93.6	.514	1	1 1/4	6
600 to 8	69.8	79	770	68.8	.378	1	1 1/4	5
600 to 5	55.0	100	770	54.5	.299	7/8	1	5
300 to 15	68.8	80	540	65.4	.359	1	1 1/4	5
300 to 8	49.7	110	540	48.3	.266	1	1	4
300 to 5	39.1	140	540	38.4	.211	7/8	1	4
72 to 15	37.0	148	270	29.2	.160	3/4	1	4
72 to 8	25.5	215	270	22.6	.124	3/4	3/4	3
72 to 5	19.7	279	270	18.3	.100	5/8	5/8	3
50 to 15	32.8	167	220	22.9	.126	3/4	3/4	3
50 to 8	21.9	250	220	18.3	.100	5/8	5/8	3
50 to 5	16.7	328	220	15.0	.082	5/8	3/4	3

Table 3

Plate Load	Ant. Imp.	Freq.	Inductance XL	Diam.	Length	Turns	Turns/Inch	XC	Cap. ($\mu\mu$f)
3000	36	3750 kc	327	2 1/2	3 1/2	21	6	330	129
5000	36	3750 kc	423	2 1/2	4	24	6	425	100
10,000	36	3750 kc	599	2 1/2	5 1/2	33	6	601	70
3000	36	7150 kc	327	2 1/2	2 1/8	13	6	330	68
5000	36	7150 kc	423	2 1/2	2 1/2	15	6	425	52
10,000	36	7150 kc	599	2 1/2	3 1/2	21	6	601	37

system. If a quarter-wave antenna is connected to *C* and a ground to *D*, the proper impedance to load a Class C amplifier will be presented at terminals *A* and *B*, provided the correct values of capacity and inductance are chosen. *Table 3* shows the amount of capacity and inductance necessary to match 36 ohms to 3,000, 5,000, and 10,000-ohm plate loads on 80 and 40 meters. A rough estimate of the impedance required by a Class C amplifier can be made by dividing plate voltage by the desired "loaded" plate current. This is sufficiently accurate since some measure of adjustment must be provided in any case.

The ideal arrangement would be to have both L and C continuously variable. The inductance could be a "roller" coil such as is manufactured by Silver, Johnson, Barker & Williamson and others. Many of these have appeared on the surplus market. Lacking one of these, a simple tapped coil could be used. The tank condenser would be selected in the same manner as for any other Class C amplifier, taking into account the plate voltage that is to be used. The desirability of a continuously variable inductance will become obvious from the tuning procedure.

The following procedure should be followed in loading the Class C amplifier. First, short terminals *C* and *D*, apply power and dip the tank circuit. Since there are an infinite number of combinations of L and C that will hit resonance, a combination should be selected which uses the minimum capacity available in the tank condenser. The short should then be removed and the antenna and ground should be connected to *C* and *D*. Assuming that the antenna does not present a pure resistance, the tank circuit should be re-dipped *using the variable inductance.* The new value of plate current will be higher, indicating that power is being delivered to the antenna. To increase the load, slowly increase the amount of capacity in the circuit, each time re-dipping with the variable inductance. This seemingly wrong tuning method is based on the nature of the network. The impedance across the input terminals of the

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75 watts phone and c.w. complete in one compact cabinet.

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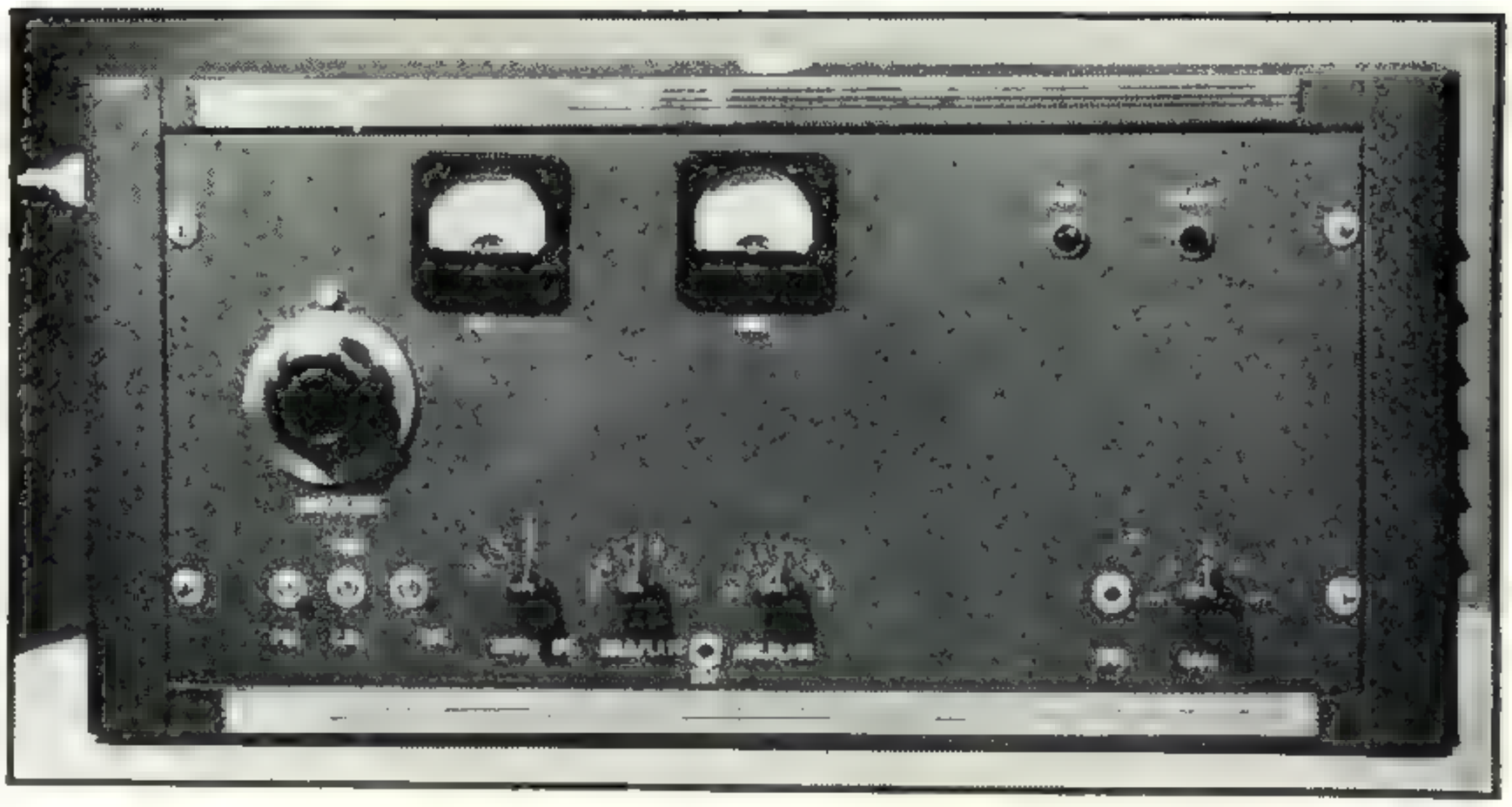

Medium-Power Table-Top Transmitter

TOM SMITH, W6EZS*

COMPACT TRANSMITTERS are still much in demand with no apparent lessening of the housing shortage in sight. With this thought in mind we started to lay out a small rig that would be economical to construct, be straightforward in design, and incorporate sufficient power on phone or c.w. to give some 100% QSOs. The result of this work is the 75-watt utility transmitter outlined in this article. Despite its small size and modest power, numerous DX contacts have been made and consistent intra-continental work is enjoyed on all bands.

Design Details

The entire transmitter is mounted in a standard relay rack type receiver cabinet which has an opening to accept an 8¾" or 19" panel. The r-f section of the transmitter and the modulator are mounted on separate chassis for convenience of wiring, better shielding, and greater over-all flexibility. The r-f portion of the rig is mounted on a 10" x 12" x 3" chassis. The modulator is mounted on a 7"x12"x3" chassis. A male and female octal chassis plug combination is mounted on the sides of the chassis facing each other, approximately two inches from the rear of each individual unit. The placement should be carefully made so the sections of the plug align perfectly when the units are brought flush to the front panel. This plug connection joins the two units and is fastened just before bolting the last unit onto the front panel.

The r-f section consists of a 6L6 harmonic oscillator, a 6L6 doubler or buffer driving an 815 in push-pull as the power amplifier. Standard commercial coils are used in the second stage and final. Small plug-in forms are wound for the oscillator. Coil data is included in the coil table accompanying the parts list. The 815 tetrode was inclined to be slightly unstable in working out our initial layout, but after experimenting with the placement of parts and component values we were able to get perfect performance without neutralization. Variable grid coupling condensers were employed to balance the drive to the 815 grids.

The modulator, designed to have ample gain with any crystal microphone, uses a 6SQ7 high-gain input, 6SC7 phase inverter, 6N7 push-pull driver and

*1737 *Beloit Ave., Los Angeles 25, Calif.*

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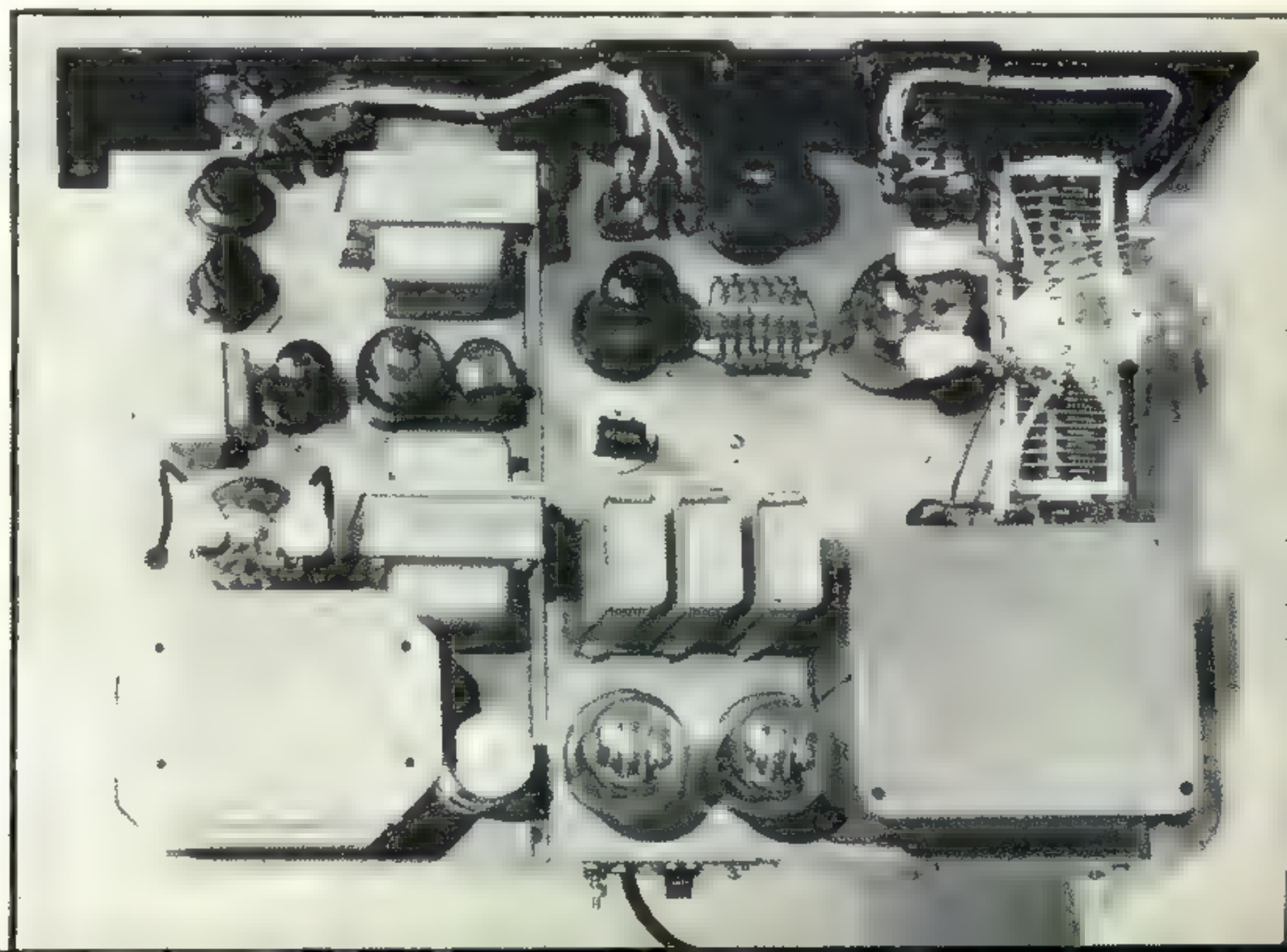
Ample room for all parts with maximum flexibility is provided by using two individual chassis.



Top: Circuit of complete r-f section. Bottom: Circuit of complete a-f section.

815 Class AB modulator. The 815 operating Class AB makes an ideal audio tube for this power rig. A separate small plate transformer supplies voltage to the speech equipment. This was found helpful in isolating the audio system and also simplified the bias circuit for the 815. Inspection of the circuit diagram will show that bias for the modulator is taken from the modulator power supply, thus eliminating any bias batteries with their attendant care.

Tuning the Transmitter

Tuning procedure is straightforward and no trouble should be experienced if the circuit diagram is followed closely. It is advisable to carefully retrace all wiring upon completion of the job. We have found it convenient to go over each lead with a colored pencil as it is put into the rig and then use another color when double checking.

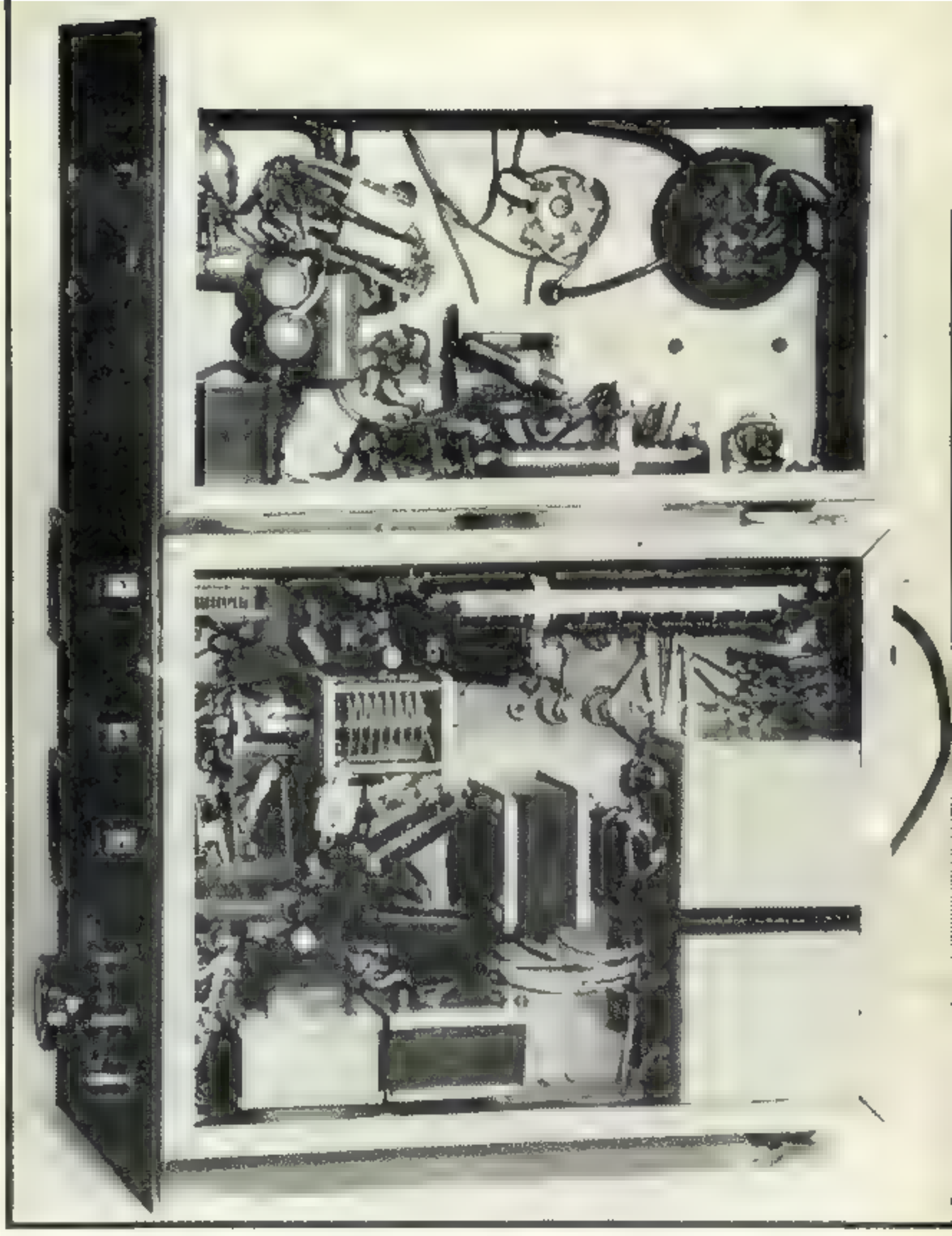
After the proper coils are selected for the desired band of operation the filament circuit should be turned on. For operation on 10 and 20 meters a 40-meter crystal must be employed. On 80 and 40 an 80-meter crystal is used. A v.f.o. can be used by plugging its output in place of the crystal. If sufficient output is available from the v.f.o., as is the case in most of the commercial units, the v.f.o. output can be linked to the plate coil of the oscillator, tube removed, the oscillator tank circuit used as a tuned grid for the buffer. If the output of the v.f.o. is obtainable on any band it can be brought to the buffer plate coil and with both 6L6s removed the buffer tank circuit can be utilized as a tuned grid for the 815. This will work well with v.f.o's such as the Meissner EX, etc.

With the meter switched to read oscillator plate current the oscillator should be resonated, then tuned slightly off resonance. This will prevent a sluggish crystal from going out of oscillation when the rig is turned on and off. The buffer stage is then resonated, with the meter switched to read buffer plate current. Final plate and screen voltage is automatically disconnected until the meter is switched into the position which reads final amplifier current so the 815 is in no danger during tune-up procedure.

During initial tuning it is important to balance the drive to the two grids of the 815. This can be done by several different methods, the simplest of which is the use of a small neon bulb indicator. A more accurate method of doing this would be to separate the r-f chokes at the common tie point and feed each with an individual 16K resistor. The grid current through the individual circuits or the voltage drop across them can be measured and balanced by adjusting the two 50-$\mu\mu$f variable condensers in the grid lines. Grid current should be approximately 1.5 ma per grid. When this operation has been completed the meter may be switched to the final which is resonated for minimum dip. The 815 should not be operated without a load for any extended period of time since the screen current may rise to a level where it could damage the tube. After making certain that the 815 circuit resonates satisfactorily the antenna link can be adjusted until the 815 current is about 150 ma.

When adjusting the modulator, *R13* should be set so that the modulator draws 25 ma minimum static current. This resistor adjustment controls the VR tube drain, which is in turn reflected through *R14* and varies the grid bias. Transformer *T4*, the 50-watt modulation transformer, is wired to give a 6200-ohm primary to a 3000-ohm secondary impedance match.

(*Continued on page 86*)



The two separate chassis are connected through an octal plug. Top is a-f chassis, bottom unit is r-f chassis.

R-F Section Parts List

J1—Closed circuit keying jack.
L1—Oscillator plate coil (see coil table).
L2—Buffer plate coil (B & W type MC).
L3—PA plate coil (B & W type JVL).
L4, L5, L6—200-ma smoothing choke.
T1—Plate transformer 525-425-0-425-525 v. @ 250 ma (UTC S40).
T2, T3—Filament transformer 5.0 v. @ 3 amp. (Thermador J-10A).
T4—Filament transformer 6.3 v. @ 4 amp. (Thermador J-18B).
SW1—DPDT toggle switch.
SW2—2-pole 3-position rotary metering switch.
SW3, SW4—SPST toggle switch.

Oscillator Coil Table

3.5 mc—60 turns close-wound, ¾" dia.
7.0 mc—25 turns close-wound, ¾" dia.
14.0 mc—11 turns spaced ¾", ¾" dia.

Modulator Section Parts List

T1—Filament transformer 6.3 v. @ 5 amp., 5 v. @ 3 amp. (Thermador J-39).
T2—Same as T1 in r-f section (or Thermador C-62A).
T3—P.P. Plates to P.P. Grids (Thordarson T-20A24).
T4—50 watt modulation transformer (U.T.C. S-20).
CH1—200-ma swinging choke (Thermador C-22A).
M1—0-200 ma d.c. meter.

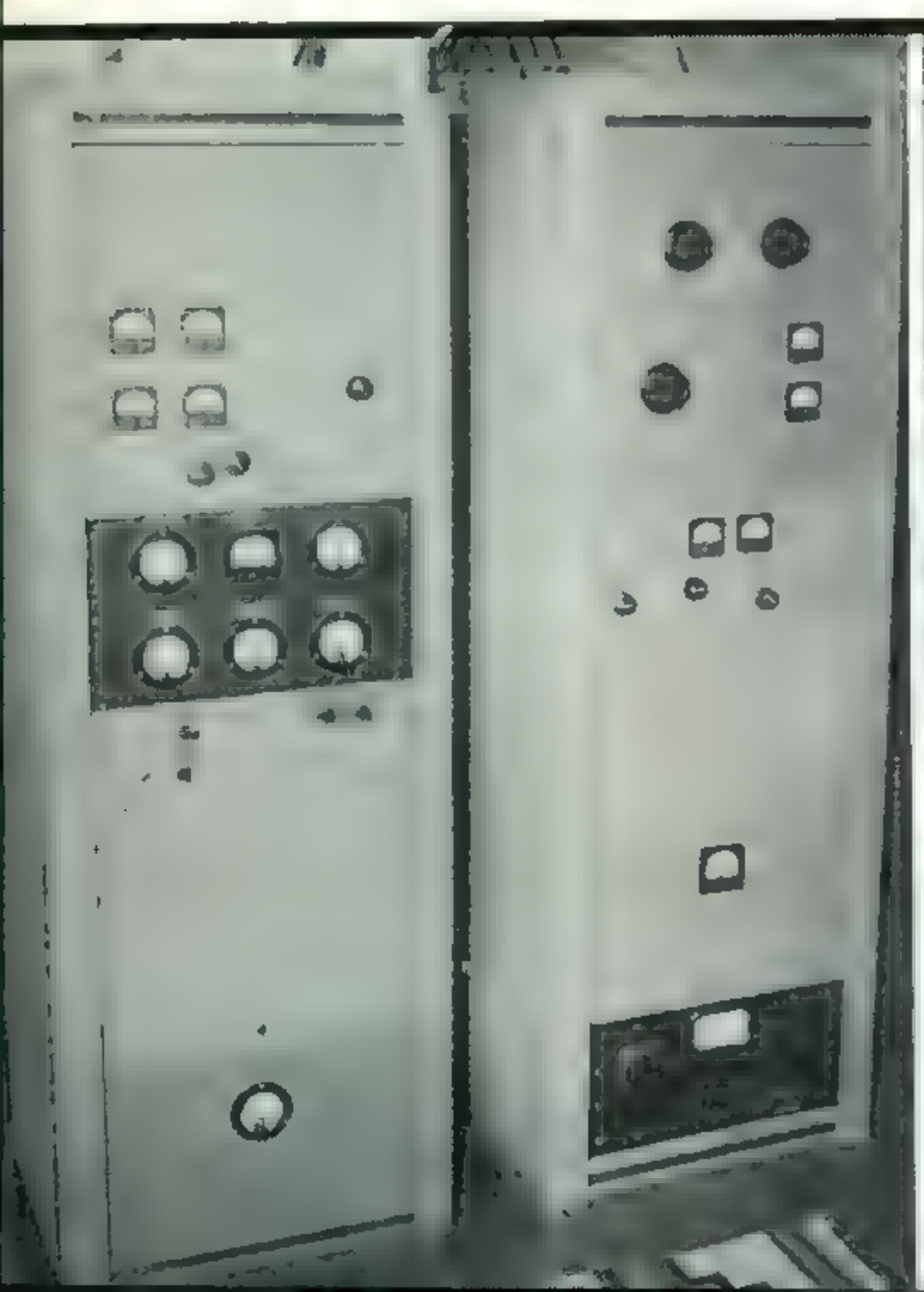
The Other Fellow's Station - W5VV

TEXAS PRODUCES more than its share of everything, so it isn't surprising to meet someone like Wilmer Allison, W5VV, hailing from the Lone Star State. One of the great tennis players of modern times, W5VV has made his mark in many fields, yet through the years has always been an active amateur. Perhaps the most remarkable thing about W5VV is that throughout the years of an extraordinarily active life he found and still finds time to do so many things. W5VV started in ham radio about 1919 and soon garnered himself quite a reputation as a DX man. WAC and WAS on 10, 20, and 40; 36 states on 6; WBE, WAAP, DXCC, W37Z, and BERTA, were just some of his operating achievements. Top W5 in the prewar DXCCC with 138 confirmed and 152 worked, Wilmer still found time to pioneer on 10, then 5, and now is making history with the 6-meter gang.

The extremely businesslike station shown in the photos is designed for maximum flexibility on the three bands that have been the stomping grounds of W5VV since the war. A fourth band will soon be covered with a 2-meter rig now under construction, ending up in 35Ts. Receiving equipment consists of an NC-2-40D, Millen "R9er," VHF-152, and panadaptor. A Meissner Signal Shifter is used to start off three separate transmitters all working from a common h-v supply and utilizing a pair of 203Z modulators. On 6, an 807 doubler drives PP35Ts with 300 watts. On 10, a 35T buffer drives VT-127s with 600 watts input. On 20, a 35T pushes PP 250THs to 800 watts. In the family car a 20-watt mobile rig and a Gonset converter keep the call on 6 when away from the home QTH.

Antennas shown in the photos are a 4-element wide-spaced rotary for 6, 3-element close-spaced 10-meter rotary, and half-wave rotary dipole on 20.

During the war Wilmer Allison served as a Colonel in the Air Force, and was instrumental in the highly successful placement of many amateurs throughout the AAF. In fact, it is safe to say that the hams had no better friend in the service than W5VV. Today Wilmer is the Texas distributor for Bellanca Aircraft —naturally he, himself, is a pilot. Married, but with no children, Wilmer's wife is the sister of the late Tom Caswell, W5BB. It is a thoroughly compatible radio family. Prewar DX men will remember the rivalry between W5VV and W5BB, which was brought to an end with the untimely passing of W5BB. Wilmer says that a lot of the competitive incentive is gone with Tom no longer on the air. W5VV is another DX man who got disgusted with postwar operating tactics on the DX bands. Out of competition, W5VV spends a good part of his time on 6 where he has had one of the most consistent Texas signals as the amateurs pioneer still another band.



Screen Safety Ballast for Large Beam Tetrodes and Pentodes

W. W. SMITH, W6BCX*

A simple and inexpensive substitute which has many advantages over protective bias when screen grid tubes are used. The author originally introduced the circuit in 1941.

As is the case with triodes, grid leak bias has many advantages when used with beam tetrodes and pentodes. It accommodates the bias to the available excitation (particularly important in the case of screen grid tubes which can be damaged by excessive grid current), and also permits more linear plate-screen modulation. Also, it is usually expedient in the case of plate-screen modulation to take the screen voltage from the final high voltage supply through a dropping resistor. However, this combination of leak bias and screen dropping resistor produces headaches when one wants to use oscillator keying, or stop and start the oscillator for break-in phone operation, or the excitation fails unexpectedly.

The use of safety bias in conjunction with a screen dropping resistor from the plate supply generally is not practical with large screen grid tubes because the screen voltage will soar excessively when excitation is removed, requiring so much safety bias that little or no grid leak can be employed, and also subjecting the screen to voltages which may damage it.

A Substitute for Safety Bias

These difficulties can be overcome by substituting for the safety bias one or two triode-connected 6L6-GA[1] tubes as a screen ballast protective device as shown in *Fig. 1*. The idea was proposed several years ago[2] but did not stir up much interest in amateur circles because of the comparatively small number of large screen grid tubes then used by hams. What with the currently widespread interest in beam tubes such as the 4-125A, 4-250A, HK257B, 828, 813, RK-65, and others, and what with the many new amateurs (and perhaps some old ones) who did not see the author's first article, it was felt that a brief description of the arrangement would be in order at this time.[3]

Referring to *Fig. 1*, when the amplifier is being excited the ballast tube is biased beyond cutoff and the amplifier acts as though the ballast tube were not in the circuit. When excitation is removed, the bias on the ballast tube drops to zero. Because of the low static plate resistance of the 6L6-GA at zero bias, it acts as a low resistance shunt from screen to ground, thus dropping the screen voltage on the amplifier to such a low value that even with no bias on the amplifier the latter will not draw enough plate current to exceed rated plate dissipation.

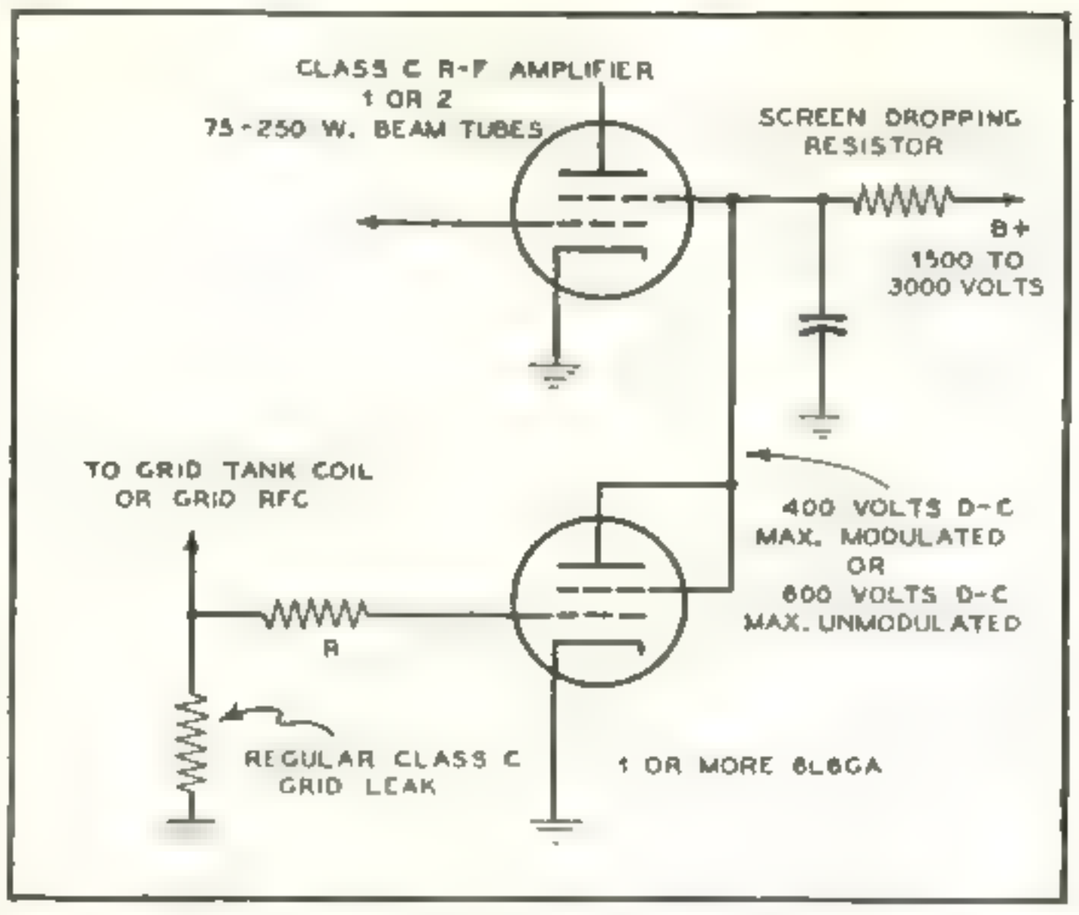


Fig. 1. Basic diagram of screen safety ballast circuit.

For the system to be economical as well as simple, the d-c screen voltage on the amplifier tube should not exceed about one quarter of the d-c plate voltage and the amplifier tube should draw but little screen current under normal operating conditions, thus permitting a high value of screen dropping resistor. If these requirements are met (and they are with all of the newer 75-250 watt dissipation beam tubes), a comparatively small ballast tube can be employed.

*201 E. Morrison Ave., Santa Maria, Calif.

[1] *A 6L6G, 6Y6, etc., will all perform equally well. 807s, which in some instances were selling for less than a 6L6, may also be employed.*

[2] *Screen safety ballast tubes were incorporated in three transmitters described recently in* CQ: *LeKashman, "Lazy Kilowatt," July, 1946; Rod, "Watt Squeezer I," Sept., 1946; Newman, "A Medium-Power Band Switching Final," Sept., 1947.*

[3] *Smith, "A Substitute for Safety Bias When Using Screen Grid Tubes,"* Radio, *December, 1941.*

It is necessary that the ballast tube not have too low an amplification factor, or otherwise it may not be completely cut off by the amplifier bias, particularly on modulation peaks if plate-screen modulation is employed. The tube must have a low static plate resistance at zero bias, in order to provide good "swamping" action. And it must have fairly good insulation between anode and other elements.

A Triode-connected 6L6-GA seems to fit the requirements best of any of the inexpensive tubes now available, doing an excellent job as a ballast tube at amplifier screen voltages up to 600 volts unmodulated and 400 volts modulated. While this considerably exceeds the maximum screen voltage rating of a 6L6-GA, the tube seems to stand up and take it like a little man with no complaints.

This leads one to suspect that the screen voltage rating on the 6L6-GA is very conservative from the standpoint of flash-over (at least in the case of this application), but if one *should* happen to run across a 6L6-GA that is a "weak sister" and shows a tendency to flash over on modulation peaks, no damage is inflicted on the Class C amplifier tube. This fact, coupled with the low cost of the tube, would seem to justify such operation of the 6L6-GA even though the manufacturer may not recommend it. If it makes them too uncomfortable, perhaps they will bring us out an inexpensive (as things go nowadays) high Gm triode designed either specifically or incidentally for this type of service.

It is necessary that the bias on the Class C amplifier under normal operating conditions be at least ⅓ the d-c screen voltage for c-w operation and at least ⅓ the d-c screen voltage (and preferably slightly more) for plate-screen modulated phone operation. With most of the newer screen grid tubes in the 75-250 watt class, running according to manufacturer's recommendations, the requirement will either be met or almost met. If the condition does not exist when running normal grid current, one need only increase the grid leak value until it does. This takes a little more excitation but won't hurt the amplifier tube, because the "typical operation" bias recommended by the manufacturer seldom is even half what the tube will stand safely.

It will be noted that when the Class C screen voltage is but a small proportion of the plate voltage, the dissipation in the screen dropping resistor increases only slightly when the excitation is removed and the ballast tube goes to work. This means that incorporation of the safety ballast tube requires only a slightly huskier resistor than if the ballast feature were not employed.

The resistance value of the screen dropping resistor should be chosen or adjusted without regard to the ballast tube. The wattage rating for c-w operation should be determined by assuming that the resistor is placed across the high voltage power supply and calculating the current flow and wattage. This is slightly more than the resistor will be called upon to dissipate under conditions of no excitation, and gives an adequate but not wasteful safety factor. For phone operation the wattage rating should be increased by about 50% to be on the safe side.

While it is possible to calculate in advance whether one 6L6-GA will do the trick or whether two in parallel are required, the simplest thing to do is try a single one, and if that doesn't pull the static plate current down sufficiently on the Class C amplifier to keep the dissipation within rating, then hang on another 6L6-GA in parallel. Seldom will more than one be required for a single Class C tube of any of the aforementioned types, and seldom will more than two 6L6-GAs be required for any pair.

The 25,000-ohm carbon resistor in the grid of each 6L6-GA is good insurance against parasitics in the ballast circuit especially if two tubes are used in parallel.

It is imperative when using this system that the Class C stage itself be free of self-oscillation, either at the fundamental or a parasitic frequency, because oscillation in the Class C stage will develop bias which "releases" the ballast tube. However, the requirement that the amplifier be "clean" should not be considered a disadvantage; the rig should be anyway!

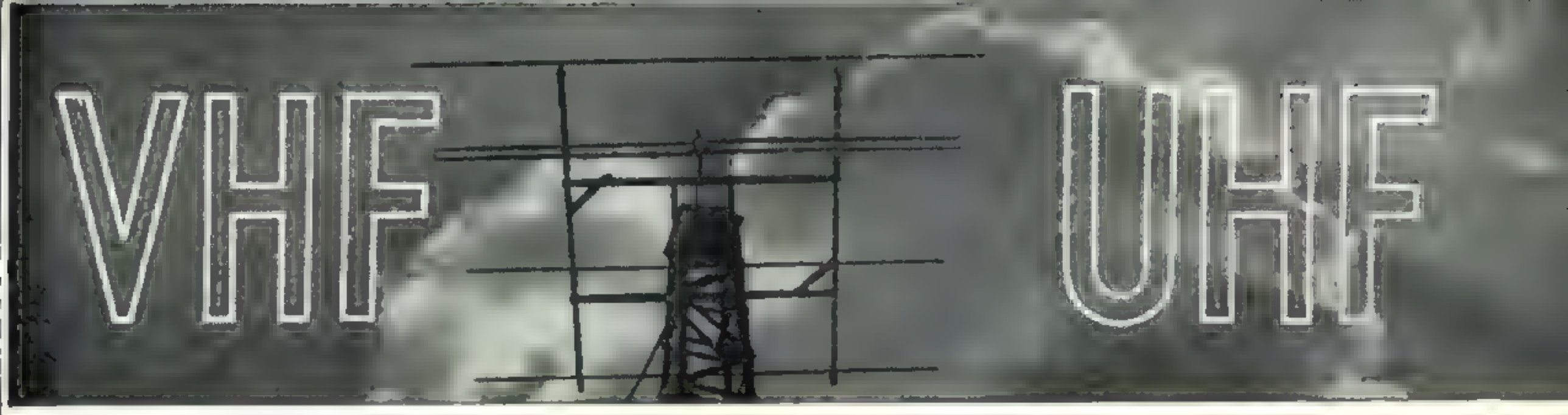
But in case you are one of those people who just can't stand to see the final amplifier draw a little resting plate current (on break-in phone or oscillator-keyed c.w.), then the ballast tube has still a lot to recommend it. When using safety screen ballast a couple of 4½ volt C batteries in series, or at most a single 22½-volt block, will provide enough grid bias to cut the tube off colder than the proverbial mackerel. With the screen voltage swamped down to a small fraction of its normal operating value, it takes very little fixed bias to cut the tube off completely. And because this amount of fixed bias will be so small compared to the bias developed by the grid leak when the tube is excited, all the advantages of grid leak bias are retained.

Postscript

Father Gets Hero Son's Amateur Call

The F.C.C. granted Ernest Melvey, 6416 Francis Avenue, Seattle, Washington, permission to change his amateur station call letters from W7HVS to W7HUX. To do so it waived Section 12.81 of its rules which requires that amateur calls be assigned systematically to prevent impartiality. The extenuating circumstances which caused the Commission to make this exception was Mr. Melvey's desire to use the call letters of an amateur station which had been operated by his late son, Robert, who died in action aboard the cruiser NASHVILLE when that ship was hit by a Japanese suicide plane during the war. The Commission was impressed by the father's wish to perpetuate his son's call letters on the air "in remembrance of the good times" the two had together. In granting this particular request, however, the Commission indicated that it did not mean that it was relaxing its long adhered to policy against transfer of amateur call leters or requests for particular amateur calls.

—F.C.C. Press Release



Conducted by VINCE DAWSON, JR., WØZJB*

On Oct. 7 between 0230 and 0345 GMT W6UXN and J9AAO, Okinawa, exchanged calls on 6 meters. Signals were heard from both sides, but specific contact was not made. J9AAO peaked to S7 at W6UXN with very rapid QSB, making the signal difficult to copy. W6UXN, using m.c.w., was readibility 3, peaking to S3, with the signal unreadable most of the time at J9AAO. G5BY on 28 mc worked ZS1P on 50 mc Oct. 4 at 1357 GMT. ZS1P reached S7 on c.w.

NEW RECORDS on both 144 and 50 mc are the highlights of the news this month. Six-meter F-2 DX has broken earlier than expected, and the 2-meter band has provided the gang with thrills and chills, for there have been several good "ducts" from the Pa.-Ohio areas to Michigan, Wisconsin, Illinois and Iowa. The Western boys have long vowed their intentions to get the record and have now succeeded. How long it will remain is any one's guess, with the way the 2-meter band has been acting.

The new record on 6 meters is now held between W7ACS/KH6 near Pearl Harbor and VK5KL in Perth, Australia, a distance of 5350 miles, superseding the old record between J9AAK and KH6DD-W7ACS/KH6 of 4600 miles.

It was a great day for Gene Piety, W7ACS/KH6, on August 25th, when he was casually tuning and calling on the 50-mc band around 1630 PST. At 1701 VK5KL popped through, S-1, calling Gene. By 1706 the signal built up to S-6 when two-way contact was made, the contact lasting until 1721. VK5KL was hearing W7ACS/KH6, S-6 from 1630 till 1710 when Gene's signal went to S-8, until the fadeout.

The rig at W7ACS/KH6 is 70 watts to an 829B, feeding a 3-element horizontal beam. The receiver combination is an S-27 as a converter into an SX-28. Gene mentions that he has been on 50 mc since August 24th, spending 4 hours daily on the air through the week, and 12 hours on Saturdays and Sundays.

Very excellent work on F-2 DX is being done by XE1KE, B. J. Kroger in Mexico City.

On August 26th BJ was tuning 6 meters, with the rig on 28 mc, when he heard an LU6 S-9. In the excitement of changing the rig to 50 mc he forgot his call (of the LU6, that is). A few kicks were in order and the operating chair is padded with a pillow. August 27th brought better results when LU6DO was contacted from 1555 to 1430 CST, S-9. The LU would not believe he was working Mexico and insisted that someone was kidding him. BJ also heard four other LUs but they were unidentified, trying to convince LU6DO that he was really working Mexico. Sept. 15th, five more LUs were added to BJ's growing list of WAA (Worked All Argentinians). They were LU9AX, LU1AM, LU3DD, LU9AS and LU9EV, all from 1520 to 1815 CST with signals loud and strong, peaking way over S-9. BJ also mentions that XE1GE worked LU9AX c.w. both ways during the same day and time. Sept. 17th the band was again open for the LUs when LU9AS, LU1AM, LU6DR, LU3DD, LU8BQ and LU8DJE were contacted from 1730-1800 CST. Between 1840 and 2000 CST on the 18th of Sept. LU8DJE, LU1CC, LU5CK, LU3BAC, LU7AZ, LU9AS and LU6DO were worked with very nice contacts throughout the period the band stayed open. During this last opening the LUs were heard calling PY2QK and TG9JW, indicating additional activity. The distances between the LUs and XE1KE is around 4000 miles, which should make more of the South American stations take notice and join the new DX band.

We reported last month that W3GV in Erie, Pa., had heard W9ZHB in Zearing, Ill., and vice versa but no contact was made. This was the furthest west that 2-meter signals had been heard from the east and going the other way also. This month has brought a new record and quite a few contacts around 500-600 miles.

Clair Brown, WØNFN, in Solon, Ia., just south of Cedar Rapids was sold on 144 mc when on Aug. 31st he called W9BBU of Elgin, Ill., on sked at 2100. When he stood by he was amazed to hear W8WJC of Everett, Ohio (20 miles south of Cleveland), calling him, the signal running from S-7 to 8½ on the HRO meter, with a VHF-152 in front of it. W9PYM near Milwaukee, Wis., was also worked, and at 2130 W8VO in Akron was hooked, the latter being just 50 miles from the Pa. line. W8UCG, Muskegon, Mich., was worked along with more of the Ill. gang. At 2330 Clair signed with WØHAQ and was called again by W8WJC, this time the signals running S-9, plus 12 db. A nice three way resulted between WØNFM, WØHAQ and W8WJC. The distance from WØNFM to W8VO is 500 miles, and to W8WJC 450 miles. Clair now has 8 states on 2. The rig is 400 watts to a

W9ZHB, Zearing, Ill., and W9ALU, Metamora, Ill.

Send all contributions to Vince Dawson, c/o D & S Radio Supply, 107 South 3rd St., Manhattan, Kansas.

50-MC DX HONOR ROLL

Calls	States	Districts	Others
W4GJO	45	10	VE1-2-3-OA4
WØZJB	45	10	VE2-3-4-7
WØUSI	45	10	VE2-3-7
W9DWU	45	10	
W9ZHL	43	10	VE1-2-3-4-7-XE1
WØDZM	43	10	VE1-2-3-7
WØOIN	43	10	VE1-2-3-7
WØTQK	42	10	VE2-3-4-7
W9ZHB	42	10	VE3-4-7
WØBJV	42	10	VE2-3-7
W1CLS	42	10	VE1-3
WØYUQ	42	10	VE3
W3CIR/1	41	10	VE1
WØINI	41	10	VE2-3-4
W8NSS	40	10	VE1-4-VP7
WØSV	40	10	VE7
W6WNN	40	10	VE7
W4GIY	40	10	VE1
W1LLL	40	10	VE1
WØYSJ	39	10	VE2-3-7
W5AJG	38	10	VE3-XE1
W5ML	38	10	VE3-XE1
W6UXN	38	9	VE3-7
W4QN	37	10	VE2-3-OA4
W5JLY	37	10	VE7-XE1
W9UNS	37	9	
W5VV	36	10	VE7-XE1
W8QYD	36	10	VE1-4
W7FDJ	36	9	VE7
W5HF	35	10	VE1-3-4-7
W5VY	35	8	VE7
W2BYM	34	10	VE1-VP7
WØDKS	34	10	VE3
W5FRD	34	10	VE7-XE1
WØJHS	34	10	VE1-2
W7FFE	34	9	VE7
W1HDQ	33	10	VE1
W4DRZ	33	10	VE1-2-3
W6PUZ	33	10	VE3-7
W7KAD	33	10	VE7
W2RLV	32	10	VE1-2-3
W9PK	32	10	VE3-7
W7ERA	32	9	VE7
W1JLK	32	9	
W4FBH	31	10	VE1-2-3-XE1
W5LCZ	31	10	VE3-XE1
W3OMY	31	10	VE1-VP7
W9ALU	31	10	VE1-2-3-4
W4HVV	30	10	VE1-2-3
W9UIA	30	10	VE1-2-3
W5WX	30	10	VE4-7-XE1
W5RSC	30	9	VE7-XE1
W4EQM	29	10	
W3RUE	29	10	VE1
W7HEA	29	9	VE7
W6OVK	29	9	VE7
W1CLH	29	8	
W4WMI	28	9	VE1-3-7
W4EQR	28	10	
W6ANN	28	9	VE3-7
W1CGY	28	8	VE1
W4FQL	28	9	VE1
W7ACD	27	8	
W5LBG	26	8	VE7-XE1
WØDNW	26	10	
WØYKX	26	10	VE2-3
W6NAW	25	9	VE7
W5ESZ	25	8	VE7
W7BQX	25	7	VE7
W7JPA	24	8	VE7
W5LIU	24	8	
W9AB	23	9	VE1-2-3-4

pair of VT-127As, feeding a 12-element H-array horizontal.

The big news on 2 is, of course, the new DX record. It was accurately forecast by W3EKK in his October CQ article that the 600 mile record wouldn't last long . . . it didn't! The details of the new record, almost 700 miles, show that the outstanding contacts of the big opening were made within 20 minutes of each other. It was believed originally that Dawson Bliley, W3GV, of the Bliley Crystal Company, operating from his home station in Erie, Pa., held the record with WØWGZ of Grinnel, Iowa, a distance of approximately 670 miles. This contact was made at 1:30 a.m. on September 18th. It now appears that the QSO of W2TTW/2, operating on a hill near Jamestown, in western New York, with WØNFM, Solon, Iowa, made at 1:10 a.m. on the same day is in excess of 670 miles. There is certainly credit enough to be shared by these four operators and in any event W3GV and WØWGZ will be co-holders of the fixed station record.

The full reports from W2TTW and W3GV follows, quoting from W2TTW first: "On the evening of September 17th, I received a phone call from W2GBK, Sherman, N.Y., that the band was open. At 10:15 p.m., EDST, I tuned the band and heard the 9s rolling in, so called Everett Ecklund, W2ACK, and asked him to go portable with me, mainly because of rushbox QRM."

"At 12:14 a.m., EDST we were set up on the location, which is the FM site of the local broadcast station located about 5 miles due east of Frewsburgh, N. Y. It is the highest spot in Chautauqua County, elevation 2140 feet above sea level. From 12:14 to 2:45 a.m. EDST we worked the following stations, W2GBK; W8CVQ, Kalamazoo, Mich;. W9BHJ, Union, Ill.; W9PZS, Milwaukee, Wis.; W9GGH, Kenosha, Wis.; W8AKR, Breedsville, Mich.; W9MTC, Glenview, Ill.; W9BBU, Elgin, Ill.; W3RUE, Pittsburgh."

"We heard WØNFM calling W2TTW at 1:10 a.m. and copied him solid. We went back to him and gave him a report of R5, S6-7. When he returned we heard him but were unable to copy him because of QRM from W3GV in Erie. From that time on we heard him several times but QRM on him prevented a good solid QSO."

"The equipment we were using at that time was an SCR 522, both for receiving and transmitting. The transmitter was operated with normal power on it, 300 volts B + and — 160 volts bias. The antenna was a square corner reflector, 4-foot elements, legs 6 feet long, elements 7-inch spacing. The dipole was fed with 50 feet of RG-11-U, the whole outfit tied to a truck and elevated about 10 feet above ground."

"We have used the same location several times and have always found it to be very good, but admit that conditions must have been very favorable to accomplish the above results."

W3GV reports, "I came on the air at 9:00 p.m., EST, to keep a weekly schedule with VE3ADO, Toronto. While calling Toronto, with the beam pointed north, I could hear W9GGH, Kenosha, Wisc. At 9:15 p.m., EST, I called W9GGH several times, but for some reason he was unable to hear me although his signals were loud. At 9:30 made a contact with WØHAQ, Davenport, Iowa, who was coming through an S5, a distance of 555 miles. The next contact was with W9GGH at 9:45 p.m. At 9:50 p.m. EST, contacted W9PZS in Milwaukee, Wisc., who was coming through an S9, the loudest station heard throughout the evening. I had a nice long contact with him."

"The stations from greater distances started

to come in. WØNFM, Solon, Iowa, with an S4 signal was contacted at 10:40 p.m., EST, a distance of 580 miles; 12:30 a.m., EST, W9BHJ, Union, Ill.; 12:35 a.m., EST, W8AKR at Breedsville, Michigan; and 12:50 a.m., EST, W9BBU, Elgin, Ill. a distance of 430 miles. At this time the band seemed to change, signals getting somewhat weaker, but being received at a greater distance. At 1:30 a.m., EST, I contacted WØWGZ who came through an S3 from Grinnel, Iowa, a distance of 670 miles. He was receiving me 579, his signals 339. At 2:00 a.m., EST, I tried to contact WØIFB, Solon, Iowa, who was loud earlier in the evening, but getting too weak to get much through. However, I was still able to hear Grinnel, Iowa who was 90 miles farther west than Solon, and still hearing me all right. The last station heard on the band before it finally closed up was WØWGZ in Grinnel, Iowa, talking to WØIFB in Solon, Iowa."

"It was then 2:30 a.m., EST, and no other stations were being heard by that time."

"Yesterday I called WØWGZ on the telephone to confirm this contact, as I could not believe it myself. His call book QTH is Des Moines, Iowa, but he has been spending the summer in Grinnel with his rig on the air, but is leaving next week for college. His equipment consists of an SCR 522 with a 829B, 50 watts in the final. His antenna is a 16-element horizontal parasitic array."

"The equipment at W3GV is the same as before, an R.M.E. converter, 12-element horizontal antenna, and 350 watts, with two pairs of 54s. W3GV has now worked seven states and Ontario, five U.S. districts and one Canadian."

"W2GBK in Sherman, New York, worked a number of stations in Illinois, and as far west as Solon, Iowa, 610 miles for him. W3AU, Erie, Pa. worked Milwaukee, Wisc. W2RPO in Buffalo, N.Y. heard only one, that station being W9GGH in Kenosha, Wisc. He apparently is just too far east. W3AU in Erie worked W9GGH and W9PZS. W3QKI was away on vacation!"

To many of you of this type of coverage on 144 mc may seem quite puzzling, as it definitely is not a reflection from the ionosphere but takes place when a v-h-f wave is trapped in a tropospheric duct, or by super-refraction. Several good articles have appeared in past issues of *CQ* and for a complete explanation we suggest you look them up.*

International Notes

W5BSY/MM reports that on Aug. 5th, while 200 miles north of the Azores he heard several W4s breaking through on 50 mc, but sloppy call signs prevented his identifying them. Trav also brings us up to date on the contacts he had during the period from May to July. On May 16th, while 180 miles East of Bahama Islands, he worked W2BYM, W8ANN, W3OMY, W8CMS, W4FBH, BBR, EQM, WMI, HVV, W8NSS, CYE and W5JLY. Heard were W4AVT, GJO and W3IUN. May 18th, 250 miles SE of Bermuda, he heard W1CGY and W1AW. June 13th off the coast of Spain in the Mediterranean, stations worked were PAØUN, G6DH, G5BD, G2MV, G5BY and G2XC. June 14th at Gibraltar, Trav worked I1IRA, I1PB, F9AQ, I1XW, I1AY, F3HL, G5BY, F3JB. These contacts with the Europeans were made with W5BSY/MM on the 50-mc band and the Continental boys on 58.5-60 mc. This shows that the Es were fairly high. June 29th in old Bahama Channel, north coast of Cuba, Trav QSOd W4CDC. June 30th, 75 miles NE of Havana, Cuba, he got W5LCZ an W5HTZ. July 1st, near the Florida Keys, WØINI, KYF, W5LCZ and heard WØCXB, TIO, W5GNQ, W7BQX, JPA, FLQ, DF and WØYUQ. The rig at W5BSY/MM is an 815 final, 50 watts to a long wire, and a VHF-152 with horizontal dipole with ground plane or long wire for receiving.

Via W2IOP, we hear that W3KXO/Iwo Jima is on 50 mc every day about 0403Z and very anxious to QSO the states. He has heard J9ACS on Okinawa, but is still looking for his first QSO off the Island.

A letter just received from W5LCZ in Benton, Ark., says he worked OA4AE on Sept 21, from 1306 to 1325 CST, the signal from OA4AE averaging S2-4 and peaking up to S-7, with the signal staying in for 45 minutes. There was other DX worked as W5LCZ heard OA4AE working W4EID in Jacksonville, Fla.

The contact with OA4AE gives W5LCZ a total of *4 countries!* The rig at W5LCZ is an 807 doubler with 40 watts into a wide-spaced beam. Surely many more of you lads in the same section of the country as Paul would like to work DX like that, even on 28 mc, yet W5LCZ is the lone representative on 50 mc from Arkansas.

50-mc Openings

Now that our V-H-F Propagation Reporting Forms have been distributed, we hope it will be easier for you to drop a report on any v-h-f band opening. More forms are available to those desiring them and may be obtained by dropping the V.H.F. Editor a card requesting them.

The first to report to us on the new form is Bish, W7HEA, who reports a fair-to-good opening on Sept. 5th from 1830 to 2001 PCT, when he worked W6VVS, SFL, LSN, AOR, WNN, NYF, QFT, FGS, OJV, WAY, TBS, AMD, all in southern Calif.

W9ALU worked W1CLS and heard W3CIR/1 on Sept. 8th.

Sept. 9th was a better opening for W9ALU when he got W3RGV and heard W2BYM, BQK, HEL at 1806, then hooked W5AEN and heard W5FRD, FSC, JLY later.

Mild aurora is reported on Sept, 12 by W9ALU when he heard the Iowa and Wisconsin gang around 1901.

Sept. 13 W8NQD was heard at 2240 by W9ALU.

W8QYD in Dayton, Ohio, reports belatedly on openings for July and surprises us at the number of them, when the band was quite dead here in the Middle West. Harold now has 36 states. VEI-4.

W6ANN sends his openings for July and adds they are pitifully lacking W1-2-3 contacts. Ask the Oregon lads, Bill, about this as they did very well to those districts. Bill, W6ANN, spent his vacation as any good 6-meter man would by visiting some of the gang he had contacted, including: W7NCR, SP, QQD, ILL, ACD and W6OVK. Bill and W6OVK each had a good cry about the few band openings they have on the West Coast.

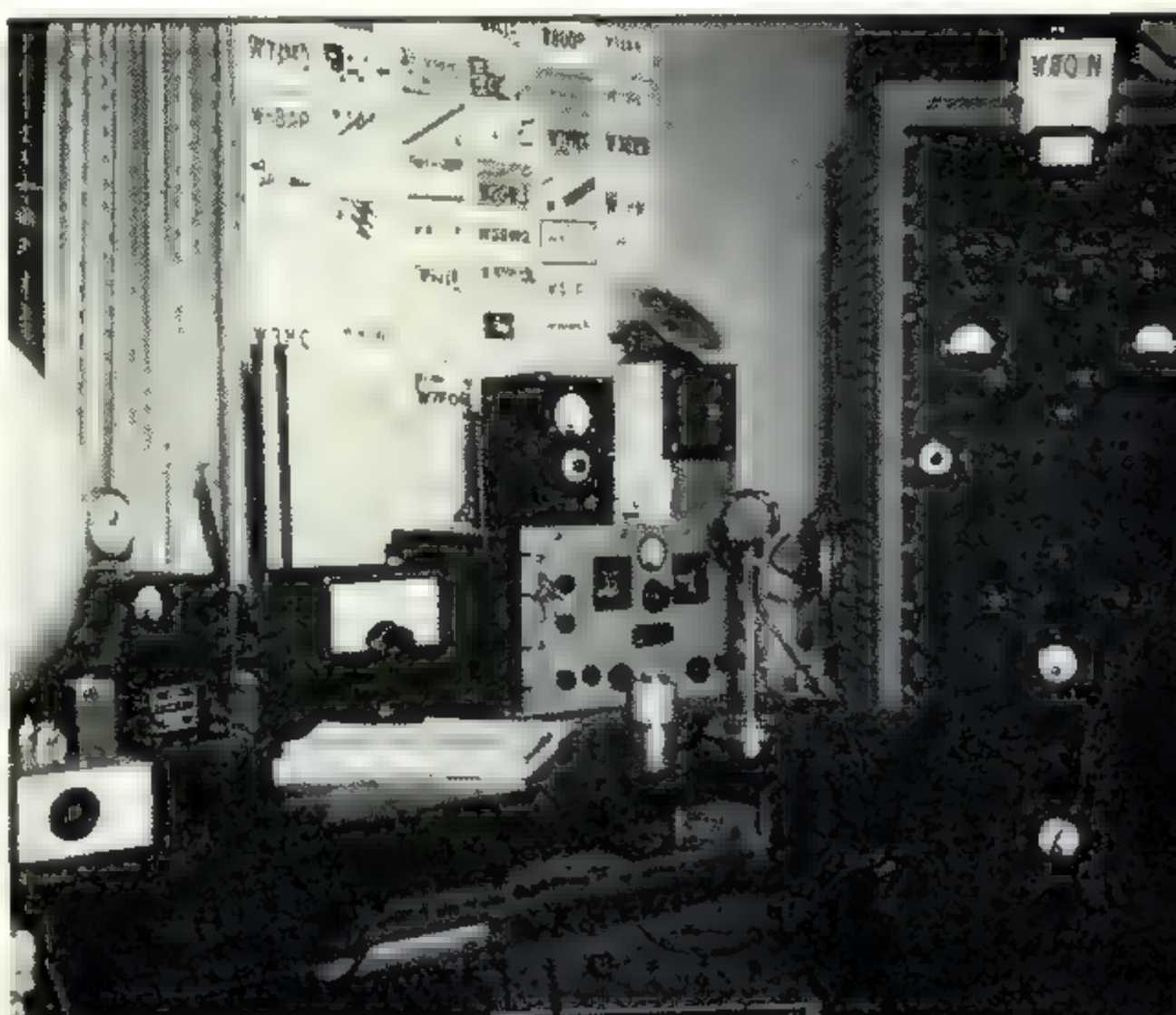
W9ZHL, in Terre Haute, Ind., says the band openings in August were way down, compared to the previous months. Charles got W7JRG in Sheridan, Wyo., on Aug 21 for state 43 and VE1-2-3-4-7 and XE1 all since January, 1947.

W5VV, vacationing in Maine, which naturally included a 50-mc rig in the car, wants to know where all the activity is

(*Continued on page 74*)

*1-Super-Refraction, W5HGU, CQ, Oct. 1946, page 14.
2-More on Super-Refraction, CQ, Aug. 1947, page 31, O. P. Farrell-A. Wilson.

WØQIN, Minneapolis, Minn.



Monthly DX Predictions-November

OLIVER PERRY FERRELL*

THE DATA OF RADIO WAVE transmission conditions may be expressed in various forms of graphic presentation. The most common is the graph of the maximum usable frequencies (MUF). These may be easily computed for any path and for any month of the year. When arranged, the MUF outlines will indicate to a high degree of accuracy the opening and closing times on any amateur band. This graph does not, however, indicate the conditions that will actually exist during the open period.

As most amateurs are aware, during the period when a certain path is open there is an hour-to-hour change in the signal intensities. This variation can be computed—since it, too, is predictable. Thus, our MUF graphs should be modified to include the *lowest useful high frequency* at the *lowest useful radio frequency*. This has been done in our four prediction graphs this month.

Absorption

The slow hourly variation in signal intensities is due to absorption of the radio wave by the ionosphere. Absorption may occur in a number of varied forms. The principal absorption of radio wave energy takes place in the daylight hours in the D-region (80 km in height). This is the lowest of the ionosphere and is the most dense. A radio wave impinging upon the D-layer causes the free electrons (if any are present) to vibrate. Generally, these electrons reradiate a large portion of the energy they receive and the radio wave passes on into the higher regions of the ionosphere. During the daylight hours the number of free electrons varies with the zenith angle of the sun. If, however, a free electron which is vibrating and has not reradiated its energy strikes one of the air molecules—the energy of the free electron will be absorbed. Although the density of the D-region remains the same throughout the day, the number of these free electrons varies according to the position of the sun, the month of the year, and possibly the year of the sunspot cycle. Absorption is also relative to frequency and the various amounts of absorption for the important amateur bands is shown in the article on the 21.0-mc band on *page 20*.

D-region absorption is sometimes referred to as non-deviative absorption since it occurs in a region where there is little or no bending of the radio wave. Some absorption occurs near the maximum usable frequency of the period in question. This type of absorption which is accompanied by considerable bending is called deviative absorption.

The Methods of Presentation

When the MUF is known—or predicted—it is possible to calculate from the factor of absorption the lowest useful frequency over any path. Beforehand, however, it is necessary to consider the power that will be radiated, the type or quality of the receiver to be employed, and the location of receiver in respect to local man-made noises. Naturally, for any amateur installation it is nearly impossible to obtain what might be known as an average location. On the other hand, if the calculations are made on the basis of a better than average location while using the legal power limit, we will be able to indicate the span of amateur frequencies open for any period throughout the day.

To calculate the lowest useful radio frequency the following basis has been used:

1. Effective radiated power of 1000 watts. This is the power actually radiated by the antenna—not the power output of the transmitter. Thus, a beam antenna could be used with a much lower power output transmitter to obtain this kilowatt of effective radiation.
2. Employing a good communications receiver possessing a low noise factor in a better than average amateur location. That is, the location is regarded as quiet and devoid of man-made noises.
3. Employing a compromise field strength. Naturally c-w signals may be read when phone signals are completely unreadable. Utilizing the above basis it will be found that lowest useful frequency indicated in the charts will be conservative when using c-w.

The prediction graphs are now almost entirely self-explanatory. The MUF outlined is indicated by the heavy bold line in the usual fashion. The shaded area indicates that those frequencies will be unsuitable for amateur communication during the period they are encompassed. Any frequency, or any amateur band, will be open over the path indicated in the world map during the interval between the shaded area and the MUF outline. If, for example, the shaded area does not reach up to that band (10 meters) it may be fully expected that readable and workable signals will be heard during the entire period.

Readers are invited to compare the methods of presentation (field intensity as used in the 21-mc forecast on page 20 vs. the MUF and LURF shown here) and write us concerning which method they find the easiest to use. The information and the data for the prediction graphs is drawn from the CRPL booklets "Basic Radio Propagation Predictions. . . . Three Months in Advance". These are available on a subscription basis from the Superintendent of Documents, Washington 25, D.C.

Postscripts

Chicago Hobby Show

The Chicago Area Radio Club Council is participating in the Hobby Show to be held in the International Amphitheater in Chicago November 1-8. A complete station will be set up and demonstrations of ham radio as a hobby will be given, including use of emergency gear.

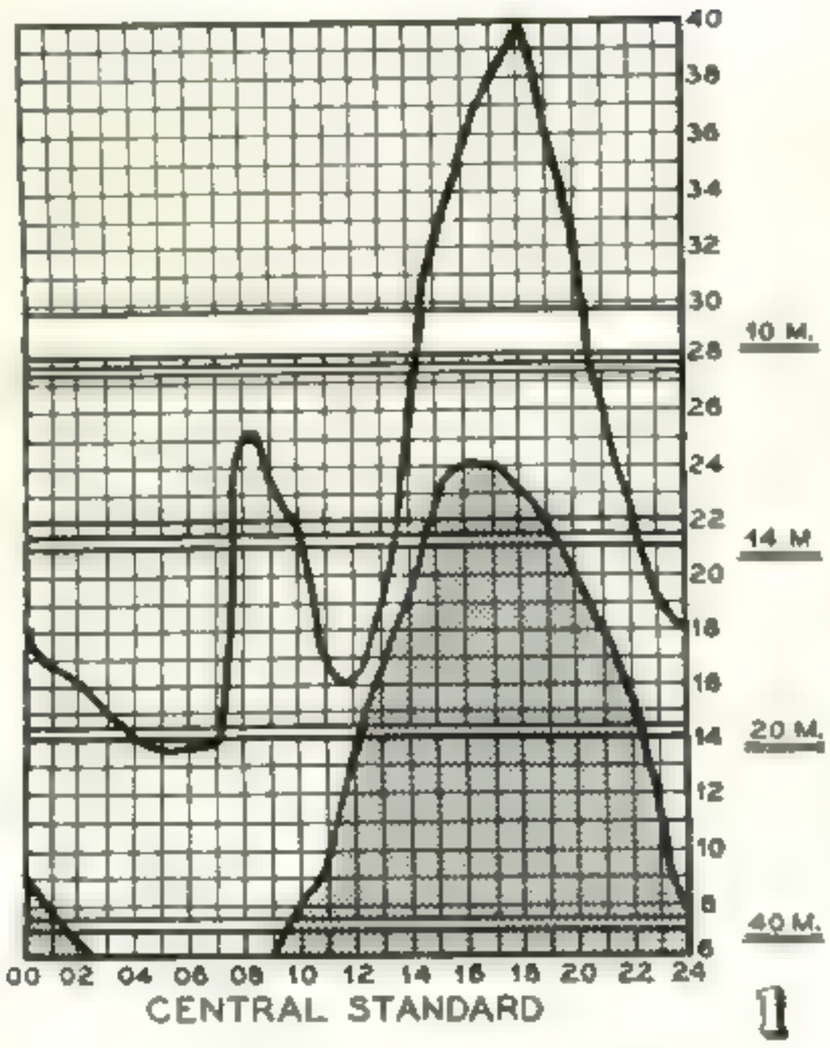
■

Key Clicks

The formula given for critical coupling in the footnote accompanying the article "A High Voltage Radio-Frequency Power Supply," October CQ, page 30, is in error. The correct formula is:

$$\text{Critical Coupling} = \sqrt{\frac{1}{Q_{\text{Primary}}\ Q_{\text{Secondary}}}}$$

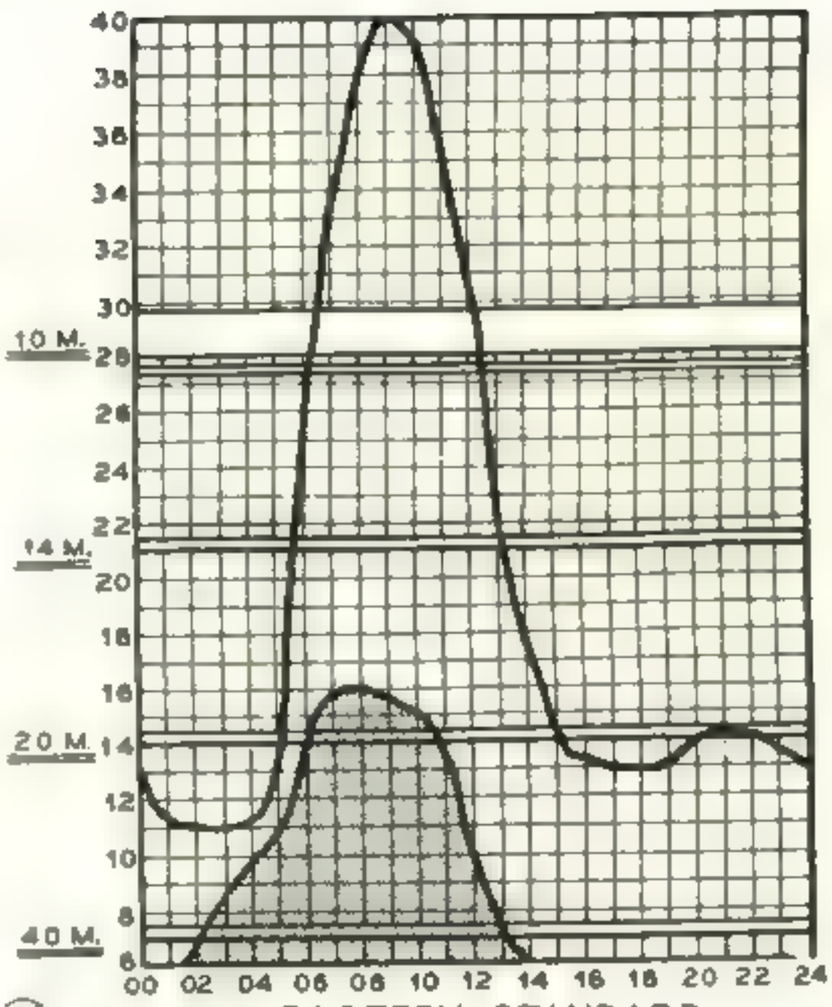
*Assistant Editor, CQ.



1

Maximum Usable Radio Frequencies—Charts show the maximum usable frequencies propagated by the F2-layer over the paths indicated in the world map. The abscissa shows the local standard time at the point of origin of the path. The ordinate shows the frequency in megacycles. Amateur frequencies fall within the two heavy parallel lines that indicate the upper and lower limits of the principal bands.

Lowest Usable Radio Frequencies—The shaded area in each chart indicates unusable radio frequencies for the illustrated path. The LUF is calculated for an above average amateur location using a good communications receiver. The effective radiated power is assumed to be 1000 watts. The LUF is based upon average monthly signal absorption and does not include the effects of abnormal or auroral zone absorption



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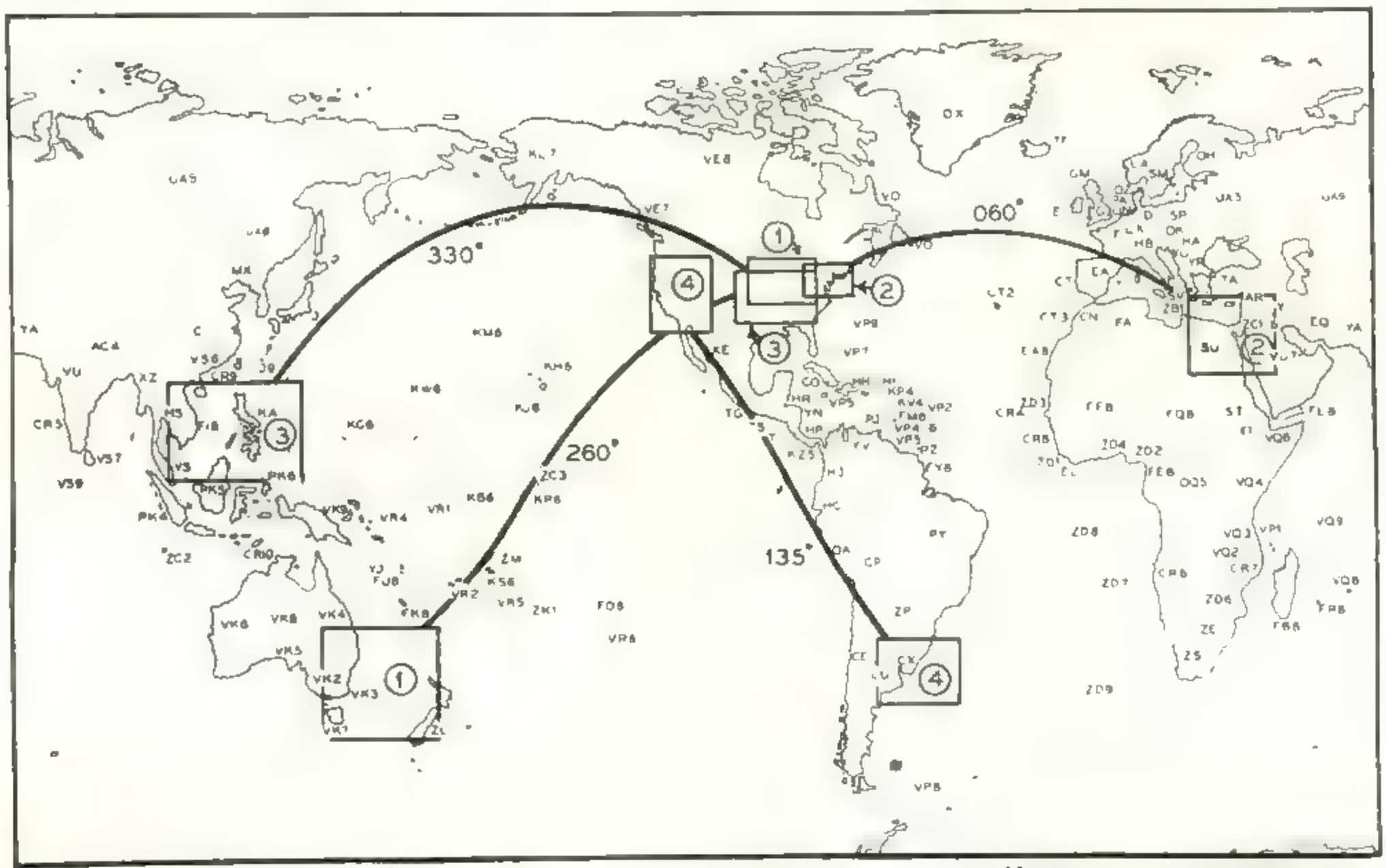
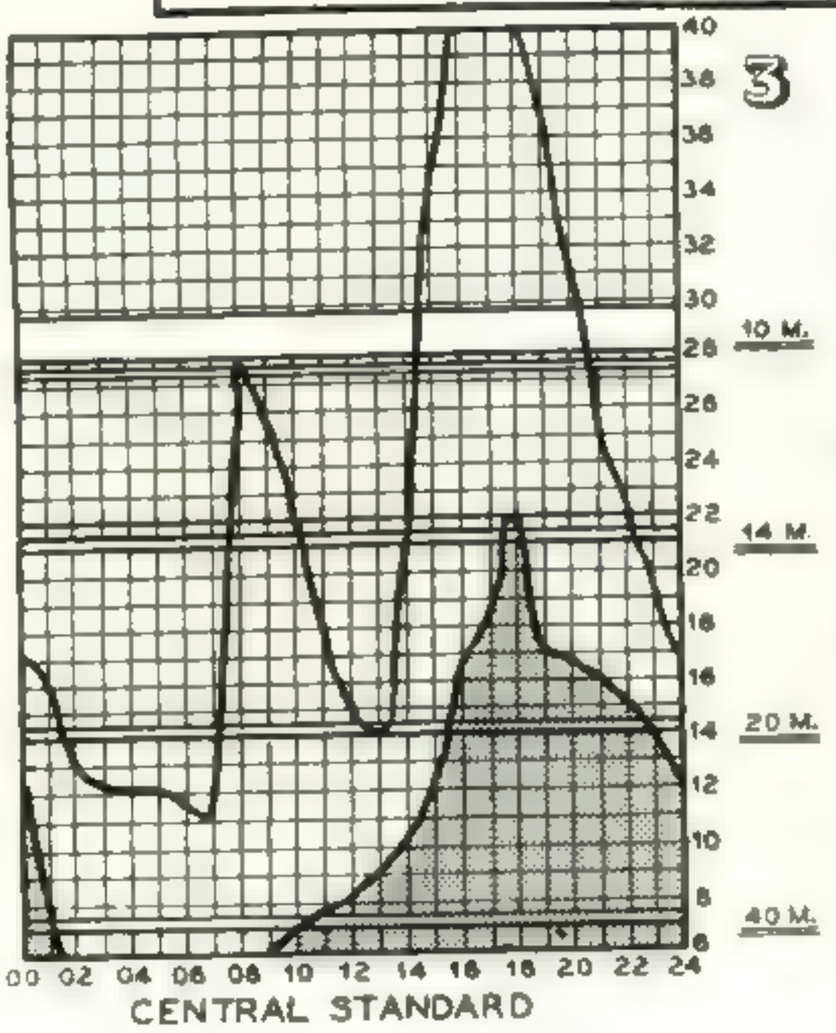
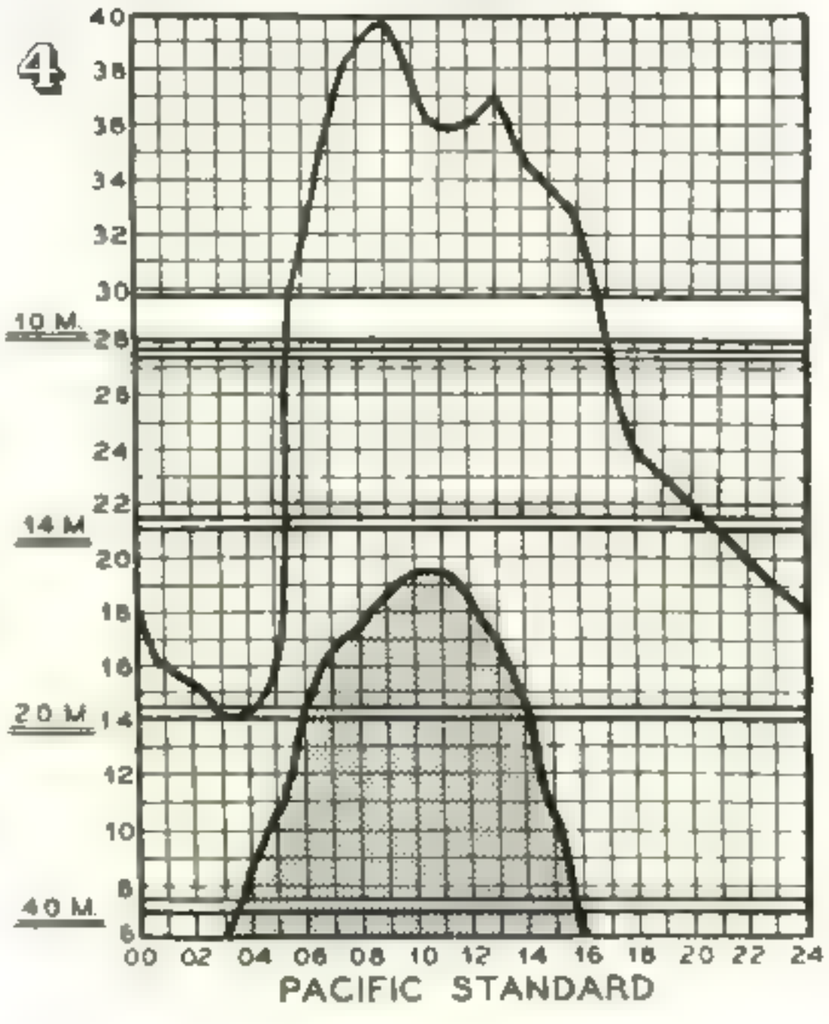




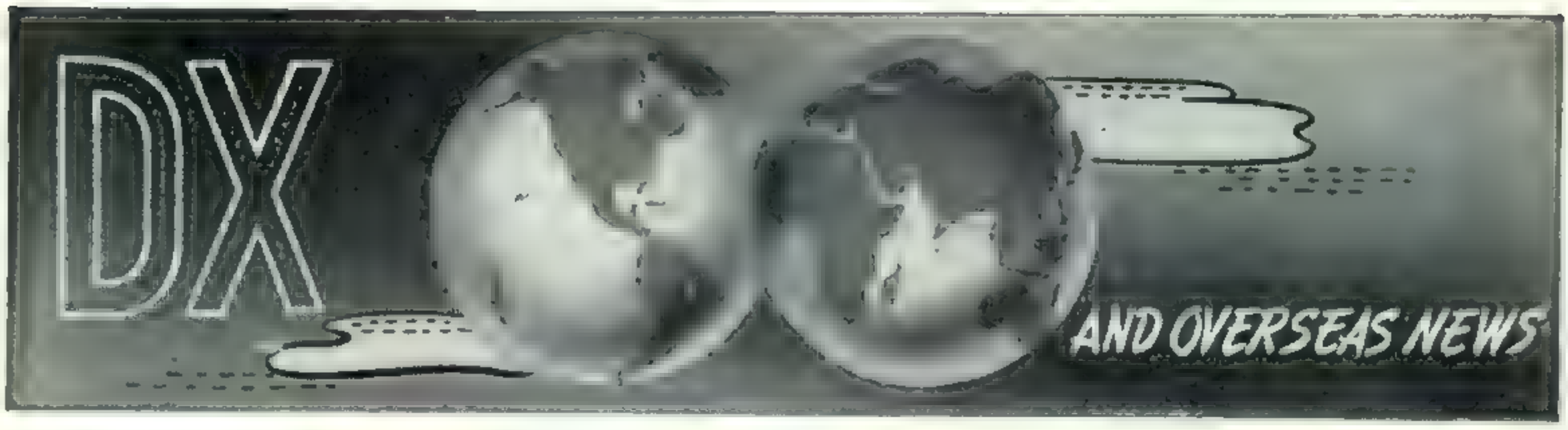
3

Azimuth—Radio transmission is known to vary considerably with geographic latitude and longitude. Each path MUF and LUF as illustrated is calculated for the "short-path". This is the path shown in the map.

Variations in Forecast—All graphs are monthly predicted average conditions. On ionospherically "quiet" days some variation amounting to less than 15% may be expected. However, a value representing 0.85 of the MUF will be exceeded over 90% of the total time. The graphs do not indicate radio propagation conditions during ionosphere storms or sudden ionosphere disturbances. They are not adjusted for the effects of sporadic-E layer formation or long and short scatter. Radio disturbances of the ionosphere storm type are the most severe for paths which pass through the auroral or polar regions, the effects gradually tapering off towards the equator.



4



Conducted by HERB BECKER, W6QD*

THIS MONTH, the W6s hit the jack-pot with four of them bouncing in with confirmations for W.A.Z. Certificates in this order will be issued:

No. 4—Bill Orr, W6SAI
No. 5—Gordon Marshall, W6ITA
No. 6—Paul Van Brunt, W6MJB
No. 7—Ed Hayes, W6SA

None of these fellows should need any introduction to you, as you've heard hundreds of DX stations coming back to them in the past year or so, I am sure. Zone 19 was the hold out in most cases, but now it looks as though cards are coming through from that zone, so we're prepared to receive a flock of W.A.Z. applications. In a way, it is a coincidence that W6SAI and W6SA should make W.A.Z. the same month. W6SAI jokingly remarked that many times he had been tempted to toss in an "I" when W6SA was signing over to some elusive DX station. All four of these fellows have really been putting on the heat for the covetted 40 zones since the war ended. You might be interested in their country totals as they stand with this issue. W6SAI, 40 and 135; W6ITA, 40 and 160; W6MJB, 40 and 157; W6SA, 40 and 147.

A few evenings ago, at one of our DX committee meetings, each of us was heckling one of the others because none had made W.A.Z. We thought that out of the five "alleged" DX men, we should have one guy capable of producing the necessary 40. Suddenly, W6SA said, "Well, if that's what you guys want, here they are," and calmly pulled 40 cards out of his pocket.

It seems rather odd that Zone 23 has been, and still is, the most elusive zone to work into, but once you work it, the card seems to come through. On the other hand, there are a flock of stations in Zone 19, and this card seems to hold up the parade. From what I hear via the grape-vine, we expect more W.A.Z. business next month.

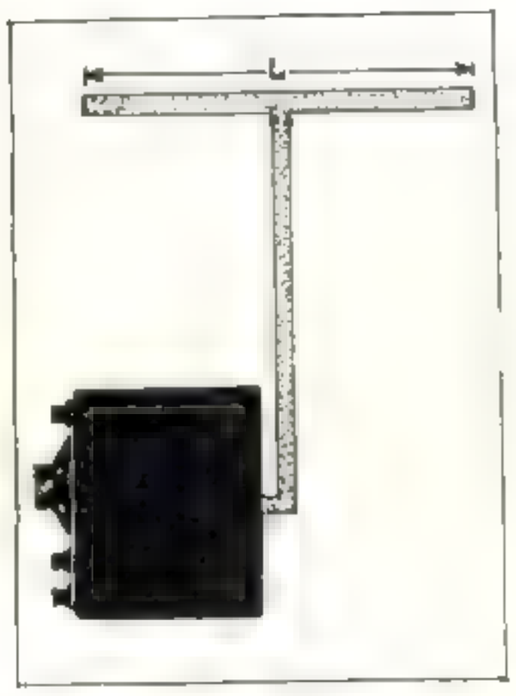
Send all contributions to Herb Becker, 1406 South Grand Ave., Los Angeles 15, Calif.

By Goodman, W1DX (left) and Herb Becker, W6QD, looking for new countries to add to official country list.

Honor Roll

The W.A.Z. Honor Roll is growing by leaps and bounds and, as you observed in the October issue, we eliminated the all-time totals. There were two reasons, one being that many of the prewar listings we have shown were not much higher than the post-war totals, the other reason being that only a small percentage of the fellows entered in the Honor Roll sent in their all-time totals. This will allow us to list more stations in the Honor Roll, and as you can see, we are fast approaching the time when the minimum zones required to be listed will be governed by the number we can set in type on one full page. This is a good place to appeal for your cooperation. The compilation and tabulation of the Zone and Country List, for the past several months, have been handled almost entirely by my very fine DX committee consisting of W6ENV, W6SA, W6DI, and W6JBO. None of the committee, or myself for that matter, can devote full time to this DX business as we have the little matter of earning a living confronting us. What I am leading up to is this. The committee spends many long hours going over the Zone and Country Lists you fellows send in, and after they have been checked, they are filed to be used as master lists. As additions from you fellows come in, we must extract from the file your master list to which we make the additions and check the totals. Some of the individual files for you fellows are growing to great proportions, especially those who send in each new country on a separate card or letter. There are a few things I think you can do to help, and I know you will.

1. Send in your original Zone List separate from your Country List with zones numbered down the page from 1 to 40. Show the call letters, date, and time.
2 Your Country list should be in alphabetical



One of the first questions that arises in the mind of the prospective amateur or short wave listener after he has purchased a receiver is "What kind of an antenna shall I use?" The answer must be modified by several factors, such as location, amount of room available, individual listener's interests, amount of money to be spent on the project, and the ambition of the individual. Most of these factors require no explanation but we would like to say at the outset, that more benefit can be obtained by spending a little extra time in construction of a good antenna system than in any other part of a receiving or transmitting set-up.

Where a receiver is to be used in conjunction with a transmitter, the transmitting antenna is undoubtedly the one to use since it will give the receiver the same gain and directional characteristics as the transmitter. In this case some sort of relay or double pole double throw switch should be used to throw the antenna lead-in from the transmitter to the receiver.

When the antenna is used for receiving purposes only, the tendency is to use the minimum antenna that will afford some sort of reception on the desired frequencies. Usually, a wire 10 to 20 feet in length is strung up over a convenient door jamb and because the local 50 kilowatt broadcast stations put in an acceptable signal, the antenna is presumed to be sufficient. Actually, as far as broadcast reception is concerned, that is all the antenna needed, since a long antenna is actually a handicap on broadcast signals, tending to overload the R.F. portion of sensitive communications receivers designed for reception of signals of less than 10 microvolts with signals in the vicinity of from 1 to 5 volts. Of course, where the nearest broadcast station is some miles away, a long antenna is quite practical on the broadcast band.

However, on short wave bands, and in particular on frequencies above 15 megacycles it is necessary to have an antenna of proper length to tune it to the frequencies desired. The tuned antenna which consists usually of two wires cut to proper lengths, will improve the operation of the receiver at the frequencies for which it is designed, because the signal strength is raised more in proportion to the stray noises picked up, than is the case with an antenna wire of random length. The feeder wires connecting the antenna to the receiver should also be matched to the antenna and receiver for maximum performance.

An easily constructed antenna that will give excellent results can be made from inexpensive 300 ohm twin lead which can be used both as antenna and feeders. A length of twin lead is figured from the following formula and cut to size.

$$L \text{ (feet)} = \frac{455}{\text{frequency (megacycles)}}$$

The two wires at either end are then soldered together. One conductor is cut at the middle and at the point of separation another length of twin lead is joined to act as feeders. The other ends of the feeders are connected to the receiver input terminals.

Usually, it is a good idea to design the antenna for the highest frequency used, and at frequencies lower than those for which the antenna is tuned, the feeders can be tied together at the receiver and the entire antenna system used as a single wire antenna. A ground connection should also be provided and experimenting with the ground connected and disconnected on various bands will show which connections are best for good results.

The receiving antenna should also be of the same polarization as the transmitting antenna for best results. In general, on frequencies below 54 megacycles, horizontal transmitting antennas are commonly used. However, on frequencies higher than 54 megacycles vertical and horizontal transmitting antennas are both in common usage.

It is also a general rule that best results will be obtained from an antenna that is free of surrounding objects and at least 30 feet above the ground. Proper care should be taken to allow for any directional effects of the antenna since antennas of the horizontal dipole type are somewhat directional and signals originating at right angles to them will be picked up with greater ease than those originating off the ends of the antenna wires.

The general problem of antenna construction is one on which much has been said and written, and further information on the subject may be obtained from any good radio handbook.

BILL BARTELL, W1PIJ

W.A.Z. HONOR ROLL

C.W.-PHONE

W2BXA	**40**	**169**
W6VFR	**40**	**168**
W6ITA	**40**	**160**
W6PFD	**40**	**158**
W6MJB	**40**	**157**
W6SA	**40**	**147**
W6SAI	**40**	**135**
W2GWE	39	178
W3BES	39	172
W8BKP	39	170
G6ZO	39	169
G2PL	39	168
W9RDZ	39	165
W2HHF	39	164
W8HYC	39	159
W6ENV	39	156
W2COK	39	150
W8LEC	39	146
W6KRI	39	144
G5DQ	39	144
W9IU	39	143
G2WW	39	143
W6ADP	39	142
G5WW	39	142
G5YV	39	141
W6SN	39	139
ZS2X	39	138
G6QB	39	137
W6TT	39	136
G8KP	39	135
W6RDR	39	134
W7FZA	39	133
G3DO	39	132
G2CDI	39	132
G2AJ	39	131
WØGKS	39	129
W6WKU	39	129
G3FJ	39	127
W9NRB	39	126
G5BJ	39	126
G5RV	39	126
WØYXO	39	122
G5WM	39	120
W6CEM	39	119
W6TI	39	119
D2KW	39	118
G6BS	39	117
W6LER	39	114
W6OMC	39	114
G3AAK	39	114
W6UZX	39	104
W6QD	39	100
W3JNN	38	148
W9PEO	38	146
W2CYS	38	114
W3EPV	38	140
W2IOP	38	137
W4BRB	38	133
W8NBK	38	132
W3IYE	38	130
W9RBI	38	129
W8FJN	38	129
W3GHD	38	126
W8CVU	38	125
W2RDK	38	124
G8IL	38	123

C.W.-PHONE

G8RL	38	115
W5CPI	38	113
ON4JW	38	110
G3QD	38	109
G3ZI	38	107
WØNTA	38	103
W7GXA	38	102
OK1AW	38	98
W6LEV	38	79
W4CYU	37	145
W4OM	37	126
WØNUC	37	126
W2HZY	37	123
W3EVW	37	123
W1BIH	37	119
W1NMP	37	119
G2VD	37	118
W1KFV	37	116
W1JYH	37	114
W3JTC	37	114
W4FPK	37	110
GW3AX	37	110
G5CI	37	109
W6EAK	37	107
W4ML	37	103
W9YNB	37	102
WØSQO	37	101
W2BLS	37	100
W6ANN	37	95
VK2ACX	37	94
W5ASG	36	141
KP4KD	36	110
W6AM	36	107
G4CP	36	101
G8RL	36	101
G6WX	36	95
W8WWU	36	93
W8HSW	36	85
G6PJ	36	66
W2DYR	35	110
G2CNN	35	109
W2RGV	35	105
W8REU	35	104
W2CWE	35	100
W9VND	35	99
W2TJF	35	89
W9MZP	35	85
W9FNR	35	85
W9TB	35	82
G6MR	35	76
G5MR	35	76
W6LN	35	63
CM2SW	34	117
G8QX	34	99
G3TK	34	99
G2CNN	34	98
W3JKO	34	91
W4DIA	34	86
W7HTB	34	84
G2AO	34	84
D4ANM	34	77
J4AAK	34	66
W7FNK	34	54
W2ZW	33	115
W4QN	33	94
W2PUD	33	89

C.W.-PHONE

G8IP	33	88
G2LC	33	85
WØAZT	33	81
W5BK	33	79
GM2UU	33	79
GW4CX	33	78
W3KDP	33	74
W9EMW	33	74
W2JA	33	74
W6ZZ	32	84
WØOUH	32	80
W2HY	32	77
W6AX	32	73
G3VA	31	101
W4HA	31	79
G5OQ	31	78
W6IFW	31	77
G2AO	31	77
W6MI	31	73
W5LVD	31	71
G8RC	31	68
W9KMN	31	66
G3BDQ	31	64
W4MZ	31	56
G8VR	30	78
G2WQ	30	76
G2VV	30	74
W2GUR	30	67
WØLAW	30	67
G5HH	30	67
W1KQH	30	65
D4AVC	30	64
G6BB	30	64
W9WEN	30	62
D4AVE	30	60

PHONE

W6DI	37	118
W1HKK	37	118
W8BKP	37	113
W4CYU	36	124
W1JCX	36	120
W2BXA	36	111
G3DO	36	104
G6WX	36	99
W3DHM	36	96
W8BF	35	108
W1MCW	35	105
W1NWO	35	92
GM2UU	35	91
W9HB	35	89
W6PCK	35	82
W2DYR	34	104
W6SA	34	71
W2ZW	33	113
W5ASG	33	83
W9RBI	32	86
W8BIQ	32	79
WØHX	32	74
W2HY	32	73
G6BW	32	69
W2NXZ	32	57
W6PXH	31	82
W5LWV	31	75
WØSQO	30	74
W4HA	30	67

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SONAR'S NEW C.F.C.

1—Direct, all-band, calibrated dial, equipped with finger tip control vernier.

2—Provisions for spot frequency xtal control and/or VFO from selector switch.

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WRITE FOR DETAILS — BULLETIN C-21

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SONAR Radio

SONAR RADIO CORP. Box 445 BKLYN 1, NEW YORK

NARROW BAND FM

1948 DX Marathon

CQ is sponsoring a DX Marathon for the year 1948. Many of the DX men feel that by the first of the year a DX Marathon will revive some of the interest that has been lost during the terrific last two years of DX. A simple set of rules governs the DX Marathon:

1. The 1948 DX Marathon begins January 1, 1948, and closes December 31, 1948.
2. Competition will be worldwide and on a zone-to-zone basis. In other words, the high station in each of the 40 zones will be given an award as winner of his zone.
3. Classifications will be the same as in the Honor Roll, i.e., "C.W.—Phone" and "Phone only", thus actually making two winners in each zone.
4. In order to receive credit, claims sent to us for zones and/or countries must be postmarked within sixty days from the date of the QSO. This will assure listing the current monthly scores in CQ and eliminate last minute entries.
5. Due to the tremendous amount of detail work, please list all DX Marathon scores on a separate page from Honor Roll scores and other DX news, and mark plainly "DX Marathon". This will greatly assist W6DI and W6SA, of our committee, in tabulating the Marathon scores for you.
6. Zone and country lists must be submitted in the same manner as though they were for the Honor Roll: the zones listed in numerical order showing the call letters, date, and time; the countries in alphabetical order by country, followed by the call, date, and time.
7. The CQ DX Zones of the world, and the official DX Country list, will be used for the yardstick.

To many of you, the beginning of the 1948 DX Marathon may seem a long way off, but we wanted to get it published so the overseas DX men will have plenty of time to hear about it. The cooperation of all DX men in the states to help spread the word overseas is requested. We think that as the years progress, it will be interesting to see who the winners are from one year to another.

order by country, after which show the call letters, date, and time.

3. When additional zones or countries are submitted for approval, send them in once a month. If they reach me by the fifteenth, there will be ample time to catch the next issue.
4. On additions to your zones and countries, show the new totals, as this will assist us in double checking with your file.
5. Do not include your zone and country additions with other DX news and contributions. This will allow easy division of duties for our committee.

All of the above may sound as though we are a little choosy, but this is not the case. It is simply because as the Honor Roll has grown the detail work has piled up, whereby the five of us, to say nothing of my brow-beaten, over-worked secretary, may not be able to carry the load much longer. You fellows will really assist us tremendously by following the above suggestions. We do not want to go into a plan of revising the Honor Roll every three months. We would like to keep it on a month-to-month basis. We will be glad to do it, but we do need your help. Yep . . . that's what we want . . . shorter hours!

Brasspounders

WØNUC thought he was hearing things the other day when he heard a guy signing *UAØKQA* and calling CQ on 14,090, and in tuning further into the band, he heard a W6 working a *UAØKQA* on 14,115. He then took a quick look at 14,090, and there was the other UAØKQA still in his CQ. WØNUC doesn't know what the answer is, and neither do we. In addition to this, he heard some other information I think you fellows would like to hear. For example, he has received his card from *ET1IR*, so would imagine he is now sending his cards through. NUC also tells me that *ZM6AC* is making a trip to Tokelau (Union Islands) and is taking a rig along. He'll probably use his call with a portable prefix. Like most of us, WØNUC runs into a disappointment now and then, but of all things to work *VR2AM*, only to discover after months of waiting, that he was operating on board the S. S. TAMBUA. As you know, stations on boats do not count. A few of the boys have worked *W6RWQ/FO8*, and, unfortunately, he is operating from aboard a yacht, therefore, we can't allow credit.

Some of us, a few months ago, met a fellow in Los Angeles who said he was PK6HA, and a few weeks ago, when I hooked *PK6HA*, I greeted him with great gusto reminding him of our meeting in Los Angeles. He said he had never been to Los Angeles, but he understood there was someone else who mentioned he was PK6HA. Anyway, before the war, he was PAØHA and since July, 1946, he has been located on Schouten Island at the Biak airstrip. Gus had worked his 100th country, but says he is certainly lacking in QSLs. He says they QSL 100%. The reason for my saying "they" is because he has bribed his XYL into writing and mailing all his QSL cards. If you fellows will take a look around the column, you will find a picture of PK6HA and his XYL.

W9FNR felt happy when he worked *YI2AM*, the other night. This one makes him 35Z and 85C. FNR runs 600 watts to a 4-250A, and has a new 2-element rotary. Up until a short time ago most of Floyd's work was done on phone, but since building his new rig he has had such good luck on c.w. he says he is going to stay at it for a while. W9MZP

(*QSY to page 64*)

PK6HA and his XYL.

Introducing 3 NEW H-K PENTODES

...with higher wattage and higher frequency ratings

Rely on these new Gammatrons for efficient amateur, emergency, or government service throughout the VHF band! The HK-27 is a small radiation-cooled instant-heating pentode ideal for mobile operations. The HK-257C is similar to the widely used 257B, but has a higher maximum frequency and lower interelectrode capacitances. The HK-357C is the first Gammatron pentode to offer 750 watts power output.

TYPE NO.	27	257C	357C
MAX. POWER OUTPUT: Class 'C' R F.	50	400	750
PLATE DISSIPATION: Watts	25	125† 100‡	250
MAX. RATINGS: Plate Volts	1000	4000	5000
Plate M.A.	100	225	375
Grid M.A.	10	25	20
MAX. FREQUENCY, Mc.: Power Amplifier	200	125	150
INTERELECTRODE CAP: C g—p u.u.f.	0.035	0.04	0.08
C Input u.u.f.	5.7	6.2	11.9
C Output u.u.f.	2.9	4.5	4.6
FILAMENT: Volts	6.3	5.0	5.0
Amperes	3.0	7.5	10.0
PHYSICAL: Length, Inches	4	5⅛	6½
Diameter, Inches	1⅜	2 11/16	3½
Weight, Oz.	1½	3½	7
Base	Small Octal	#247 Johnson	Special

† Intermittent telegraph rating
‡ Constant key down rating

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The YL's Frequency

Conducted by LOUISA DRESSER, W1OOH/2*

OUR BEST WISHES to these YLs who have only recently received new calls: W2WCL, Kathryn Sanders, of Rockaway, N. J.; W3ECF, Gertrude Schwenk, Baltimore; W4MNL, Anne Ziminski, Miami; W7LKG, Vida Beach, Klamath Falls, Ore., and W7LNF, Anna Dale, Snohomish, Wash.

Bea, W7HHH, tells us of an interesting sked she had this spring through KA1AI with a captain in the Air Force stationed in the Philippines whose wife lived in Bend, Ore. He was anxious to have his wife and daughter with him, so between W7HHH and KA1AI they ironed out over the air all the red-tape about visas, etc. Skeds were kept every Saturday for almost three months on 28-mc phone, with additional skeds on weekdays, and on only one occasion were they unable to get through. The family finally was reunited on March 28th in Manila. Bea adds: "Have talked to them twice since they arrived and they are very happy. They sent me a beautiful souvenir—a plaque made of Philippine mahogany with my name and call engraved on it by the natives."

Speaking of the Far East, Phyllis Coe, W7KSQ, was last heard from in Korea where, in addition to Red Cross and clerical work, she entertains with her accordion. During the war and immediately afterward Phyllis was in England and most of the continent doing the same work.

How many of you heard the N.Y.C. YLRL girls interviewed over WNBC the evening of August 27th? The occasion was the official opening of K2AL for the national American Legion Convention, and for which occasion WNBC broadcast a special 25-minute program. In addition to the hams sponsoring K2AL and other radio officials, Hope, W2RTZ; Grace, W2SEH, and Lillian, W2PMA, were interviewed. During the program Ray Barrett, WNBC announcer, delighted in calling the YLs "sugar-cured hams."

Many other YLs helped in the work at K2AL, including, in addition to those mentioned above: Violet, W2NQC; Catherine, W2RAQ; Helen, W2NFR; Sophie, W2QGK; Barbara, W2TWJ; Rheba, W2QJC; Emma, W2MJS; Selma, W2PUY; Sarah, W2SSX; W1OOH/2 and several XYLs and SWLs. Vi, W2NQC, who was assistant traffic manager for K2AL; Hope, W2RTZ, and "hamettes" in general had a nice write-up in the *New York World Telegram*, and the *Philadelphia Inquirer*, we understand, is publishing in a Sunday edition a feature story about K2AL with special emphasis on the YLs participating. Good publicity is one of the best things that can happen to amateur radio. If the YLs can help provide it, so much the better for our hobby.

Lizette, W7HDS, has handled over 100 messages for the veterans in the Cheyenne, Wyo., hospital, with most of the messages going out over the YLRL nets.

Joining the W7s, we hear from Amelia, W2OLB, that she is now in Seattle and will be operating a 10-meter phone rig lent to her by W7IGM.

Joanna, WØJWJ, entertained two of her former science students (one is now WØZKR) by hooking HH2CW for them on the first call. She received QSLs from four continents in two days.

Dot, W2IXY, entertained the N.Y.C. YLRL gals at their first club meeting of the new season by recounting experiences on her trip this summer during which she visited many G, ON and OZ hams. Dot said she was quite overwhelmed with the hospitality she received wherever she went and was amused to find herself somewhat of a curiosity among the hams wives in lands where there are so very few licensed YLs.

Leta, WØBDB, and Marie, WØPFO, plan to start a code class for interested YLs in the near future.

Judy, W5FJW, says she has confined her radio activities recently to her job as secretary-treasurer of the local club. Her club has been building emergency equipment which they planned to try out at a special field day of their own in October, but we imagine the "big wind" provided them with an earlier and more realistic opportunity.

Yls Elected Club Presidents

Congratulations to Mrs. Iris Boyd, WØGKU, who has just been elected president of the Sioux Falls Amateur Radio Club. Some of the boys believe she is the first woman ham club president in the country (exclusive of YLRL, of course). Iris says their club has around 35 members. Meetings are held once a week, topped off with coffee and cake.

(*Continued on page 80*)

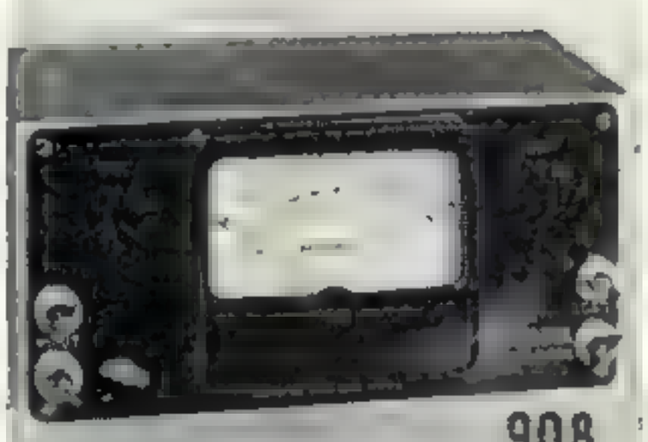
*Assistant Editor, CQ. *Send all contributions c/o CQ, 342 Madison Ave., New York 17, N. Y.*

Theresa McLaughlin, W3VYU, YL of the Month, pictured in the laboratory at Carnegie Tech.

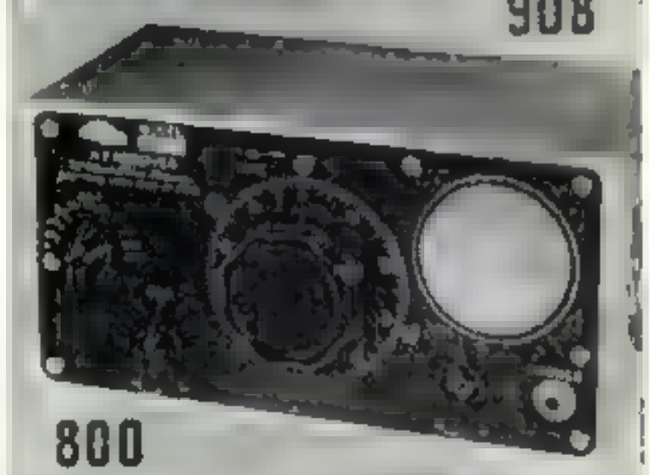
SILVER

SPELLS TOP VALUE AT LOWEST COST

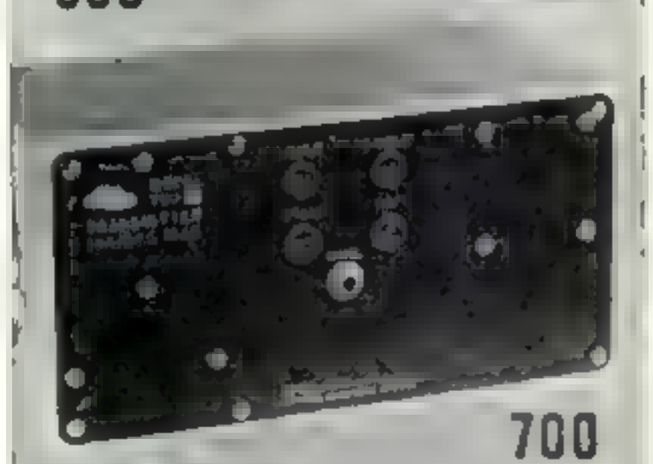
Exactly as SILVER is known the world over for producing Laboratory Caliber Electronic Test Instruments — LCETI — for critical users at unbelievably low prices, so you'll find that your dollars will buy you the most in amateur equipment when you select SILVER. Examine the instruments here illustrated and highlighted. Compare — and you'll see why more and more amateurs turn to SILVER.


908

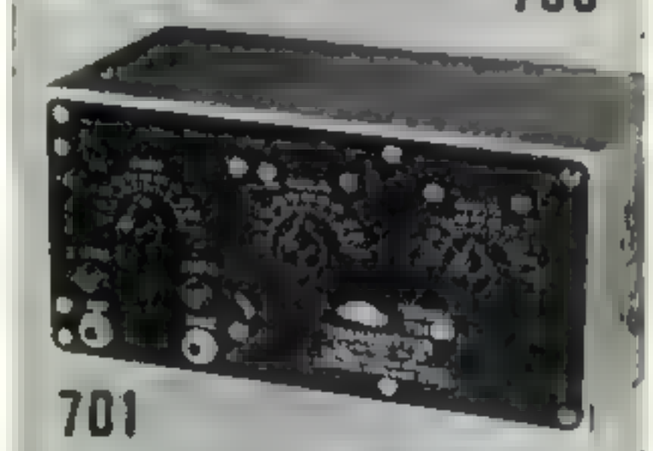
MODEL 908 MICROMATCH standing wave ratio and r.f. wattmeter will let you put more power into your antenna — from your present transmitter — for only **$29.90.**


800

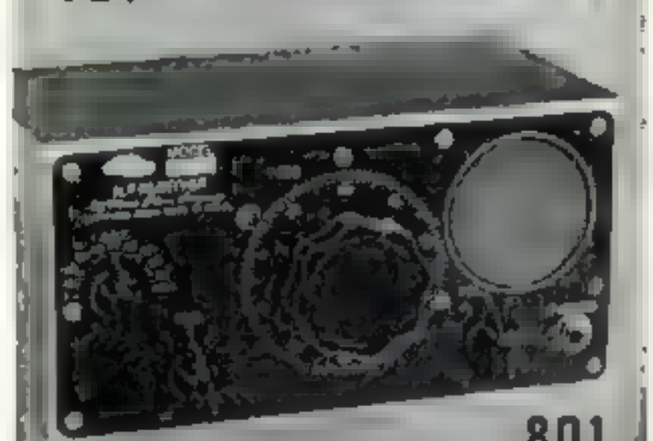
MODEL 800 U.H.F. RECEIVER is E. P. Tilton's A.R.R.L. HANDBOOK, "T.R.F. Superregenerative Receiver" — the sweetest performing 2½ and 1¼ meter, non-radiating receiver we've seen — in finished commercial form for only **$39.75** less tubes and power supply.


700

MODEL 700 U.H.F. TRANSMITTER is xtal controlled for maximum signaling effectiveness in 2½ and 1¼ meter bands, yet costs you only **$36.95** less tubes and power supply.


701

MODEL 701 TRANSMITTER goes into more amateur stations to produce more CW and phone DX than anything else, it seems. A 6AQ5 Tritet drives an 807 to 75 watts CW, 30 watts phone, input, 80 through 6 meters. Modulator is built-in. Less coils (3 per band at $ 50 ea.), power supply, 4 tubes and crystal, it's the outstanding transmitter "buy" at **$36.95.**


801

MODEL 801 RECEIVER covers 450 kc. through 60 mc., consisting of r.f. stage, regenerative detector, two a.f. stages and built-in speaker, it's the old reliable standby — just the thing for portable, emergency, test — and serious ham reception. **$29.95** for 6.3 volt operation; **$28.95** for 1.5 volt dry battery tubes; coils, **$1.00** per pair.

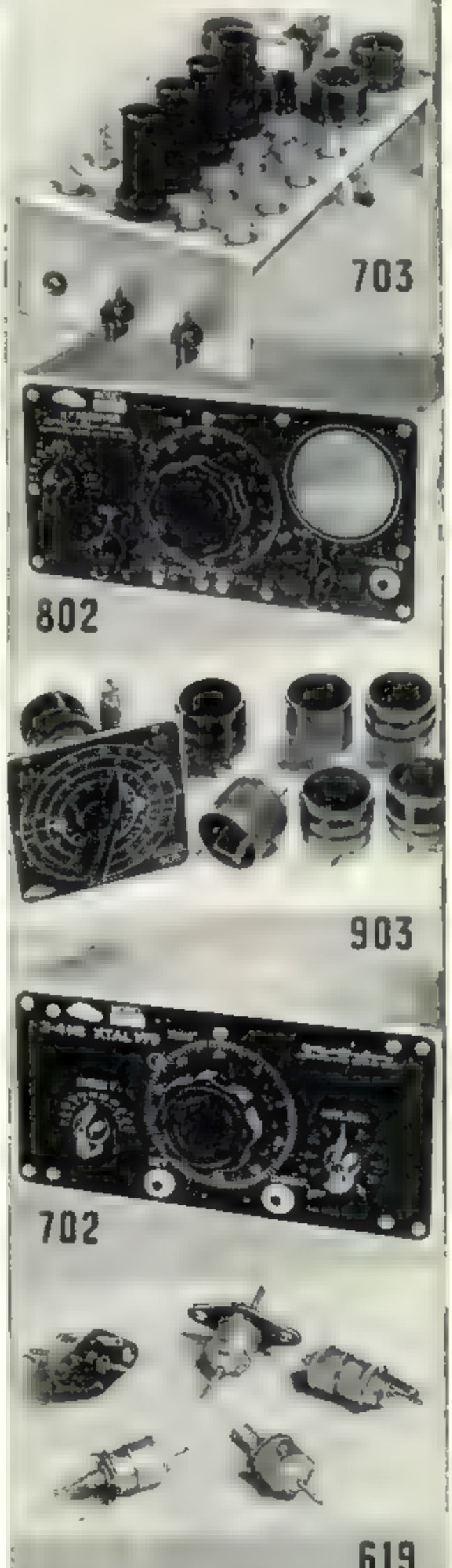
MODEL 703 is new — a pre-tuned bandpass freq. multiplier. Driven by any VFO or xtal, it puts you in any band 80 through 6 meters, on selected freq. as fast as you can turn two knobs. Its 807 gives 40 watts max. output and instant control of every band. Price **$49.90.**

MODEL 802 SUPER-HETERODYNE RECEIVER is an amateur-band-only receiver using i.f. regeneration to give variable phone up to single-signal CW selectivity. Following A.R.R.L. HANDBOOK teachings, it provides more than usual 8-tube results, over 7 feet of band spread on 80, 40, 20, 16, 11, 10 and 6 meter bands, all for only **$38.95** less tubes, power supply and coils at **$1.00** per pair.

MODEL 903 ABSORPTION WAVEMETER is close to the most useful instrument in any shack. Thousands in use attest its prime necessity. Price is but **$3.30** net, plus **$.65** ea. for plug-in coils covering 1600 kc. up to 500 mc.

MODEL 702 VFO includes NFM. Covering 3,000 through 4,000 kc., its 3-watt output may be multiplied 80 through 2½ meters. It's something brand new — a crystal controlled VFO including and using a 5 mc. xtal frequency standard to give complete break-in operation, superbly clean keying — the VFO you've dreamed would come. Only **$49.90** less tubes, including power supply.

TYPE 619 AIR TRIMMER CAPACITORS are high Q, low-loss, good up beyond 500 mc. for tuning, trimming, coupling, etc. 3 mmfd. to 30 mmfd. spread out over 3 complete revolutions for easy adjustment. Like all SILVER instruments, price is more than right—only **$.30** ea., net.


703

802

903

702

619

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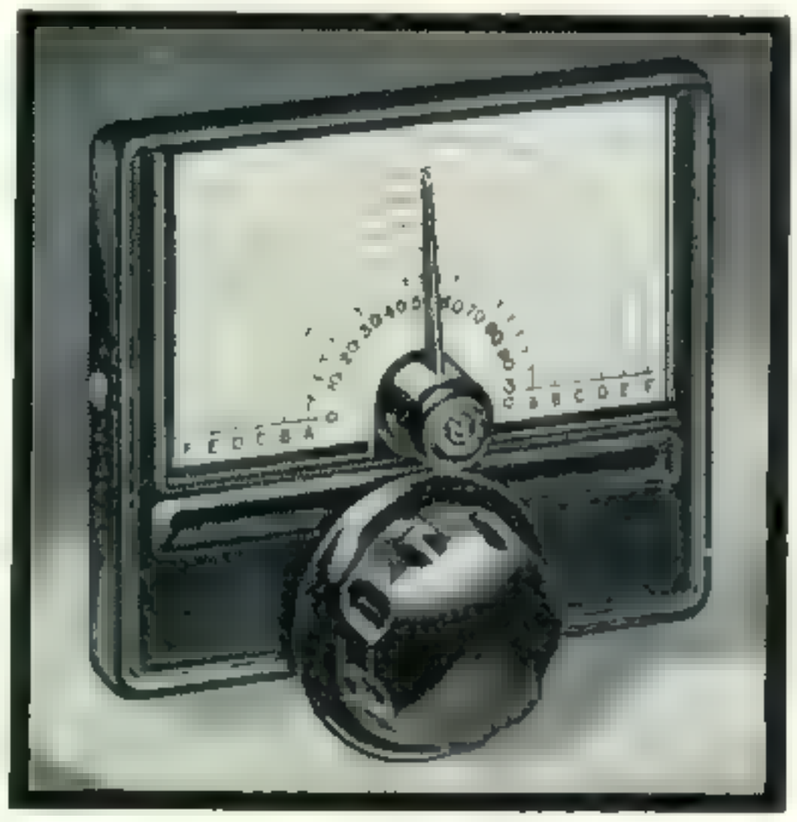
PARTS AND PRODUCTS REVIEW

Midget Vernier Dial

The James Millen Mfg. Co., Malden, Mass., has developed a midget vernier multi-scale instrument dial as a companion unit to its standard model.



This new compact dial measures 3¼" x 4", has a vernier ratio of 8 to 1, and is furnished in black art metal.

Compact Wafer Switches

Announcement is made by P. R. Mallory & Co., Inc., of the production of two new compact single and double section switches identified as RSA-50 and RSA-60.

The RSA-50 and RSA-60 are available in one or two section construction. The RSA-50 accommodates up to twelve terminals on either side of the section and provides from 2 to 6 positions. The RSA-60 accommodates up to ten terminals on either side of the section and provides from 2 to 5 positions. The RSA-60 has the narrow section design which is ideal for under chassis mounting, where space saving is paramount.

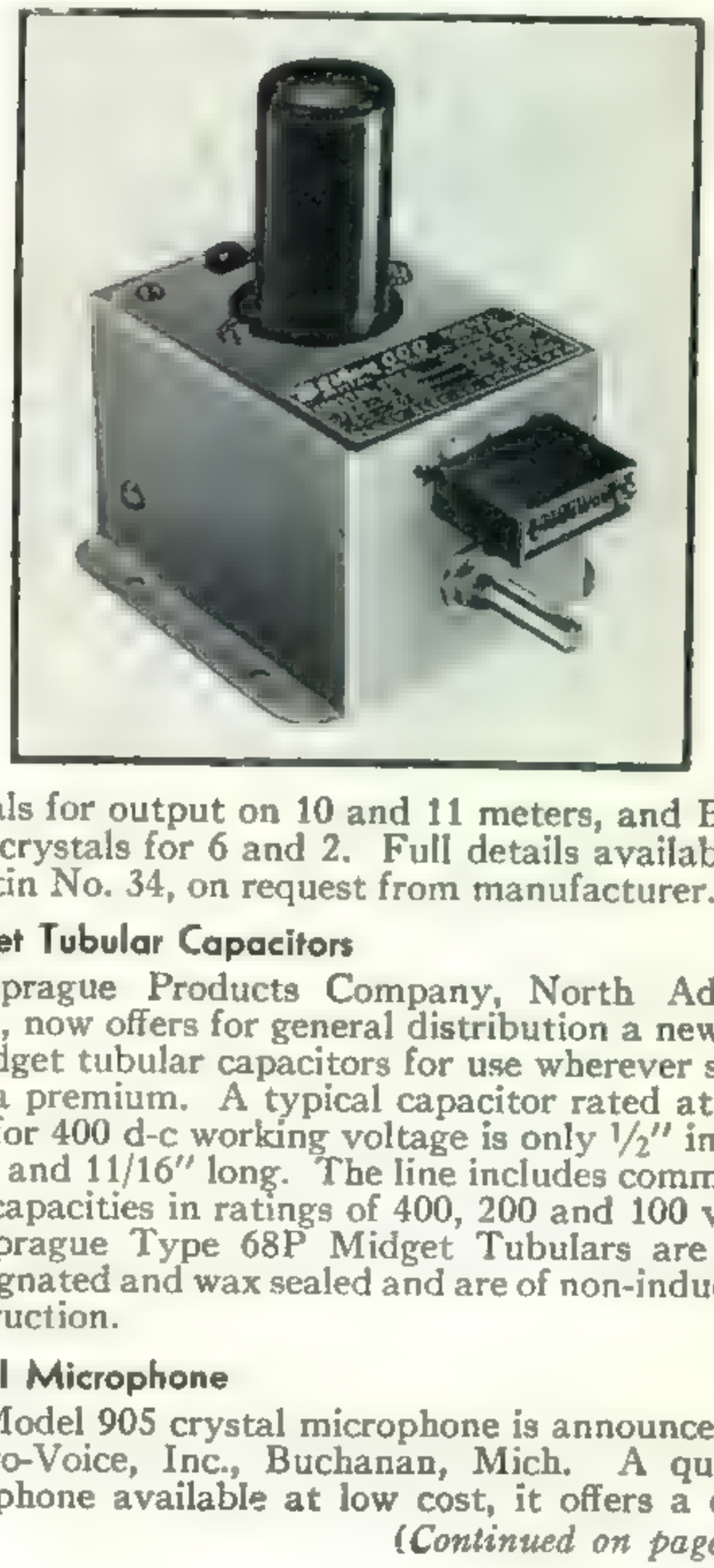
Engineering data sheets, with complete specifications for available circuit combinations with respective terminal locations, dimensional drawings, and other information, are available on request from P R. Mallory & Co., Inc., Indianapolis, Indiana.

Film Type Resistors

A line of film type precision resistors has been made commercially available for the first time by Wilkor Products, Inc., Cleveland, Ohio. Three sizes are available, CP½, ½ watt, CP1, 1 watt, and CP2, 2 watts. Tolerance in each instance is plus or minus 10% in ranges from 100 ohms to 10 megs in the ½-watt size, 10 ohms to 50 megs in the 1-watt size, and 100 ohms to 150 megs in the 2 watt size. Features of the new resistors are excellent temperature coefficient, absolute stability, low voltage coefficient, low noise level, moisture proof, small size.

Crystal-Controlled Oscillator

Bliley Electric Co., Erie, Pa., announces a crystal-controlled oscillator (CCO model 2A) providing direct output on 6-10-11 meters and ample output to drive tripler stage on 2 meters. Employing a 6AG7 tube, the advantages of v-h-f crystal control are easily achieved. It uses Bliley AX2 20-meter



crystals for output on 10 and 11 meters, and Bliley AX3 crystals for 6 and 2. Full details available in Bulletin No. 34, on request from manufacturer.

Midget Tubular Capacitors

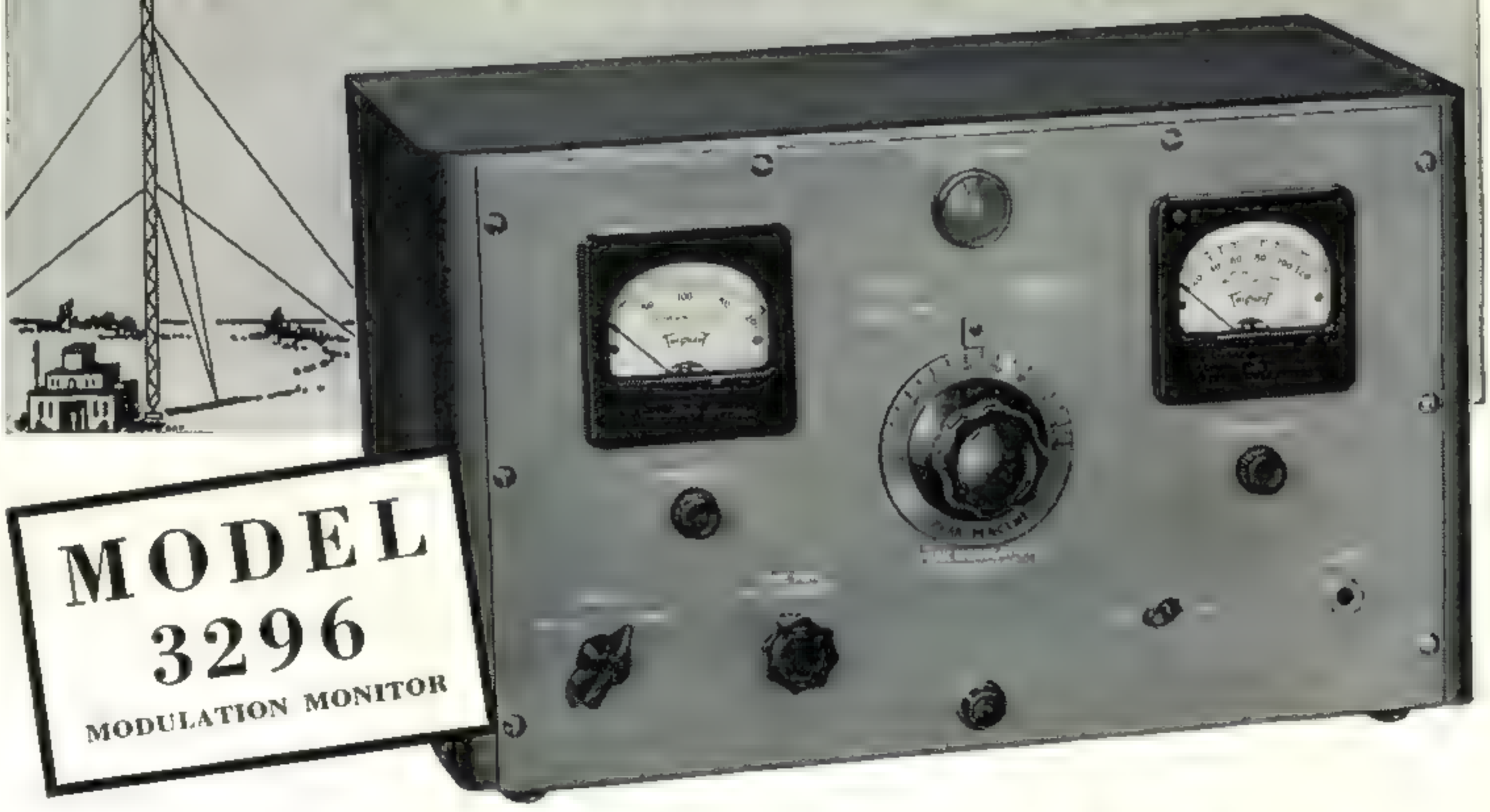
Sprague Products Company, North Adams, Mass., now offers for general distribution a new line of midget tubular capacitors for use wherever space is at a premium. A typical capacitor rated at .001 mfd. for 400 d-c working voltage is only ½" in diameter and 11/16" long. The line includes commonly used capacities in ratings of 400, 200 and 100 volts. All Sprague Type 68P Midget Tubulars are wax impregnated and wax sealed and are of non-inductive construction.

Crystal Microphone

Model 905 crystal microphone is announced by Electro-Voice, Inc., Buchanan, Mich. A quality microphone available at low cost, it offers a com-

(*Continued on page 62*)

stay away from "over modulation"



MODEL 3296
MODULATION MONITOR

MAKE THE MOST OF YOUR *Station Power*

Every time your modulation exceeds 100 percent, harmonic distortion is introduced which causes interference with other stations, and violation of FCC Regulations. With this Modulation Monitor you can modulate to the fullest for top power-output, yet you know instantly when you are *over*-modulating. Model 3296 provides four separate circuits for measuring amplitude modulation—(1) percent modulation, average; (2) peak flash percent modulation; (3) carrier shift; and (4) audio output for headphones. These methods may be used separately, all at once, or in any combination. The peak indicator can be pre-set for any percent of modulation from 20 to 120, and will flash when pre-determined modulation is reached. You can figuratively "see" the signal received by your listener!

A handsome, precision-built instrument, Model 3296 blends with any standard amateur equipment, enhances the appearance of your station, and will greatly step up your operating efficiency.

VOLT-OHM-MILLIAMMETER

MODEL 666HH

A new streamlined tester with wider ranges: A.C. and D.C. Volts 0-10-50-250-1000-5000 at 1000 ohms per volt; D.C. Milliamperes 0-10-100-500; ohms 0-2,000-400,000. Molded, insulated, pocket-size case. A top value.

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Your money buys 5 times as much...!

Now . . . when prices are high, you have to be on the "lookout" for savings. When you can buy five items for the price of one . . . that's **REAL SAVINGS!** The Bud GX-79 GIMIX is five units "all-in-one" and all for the price of one. Here's how you can use it on Amateur Radio Bands of 80, 40, 20, 15, and 10 meters

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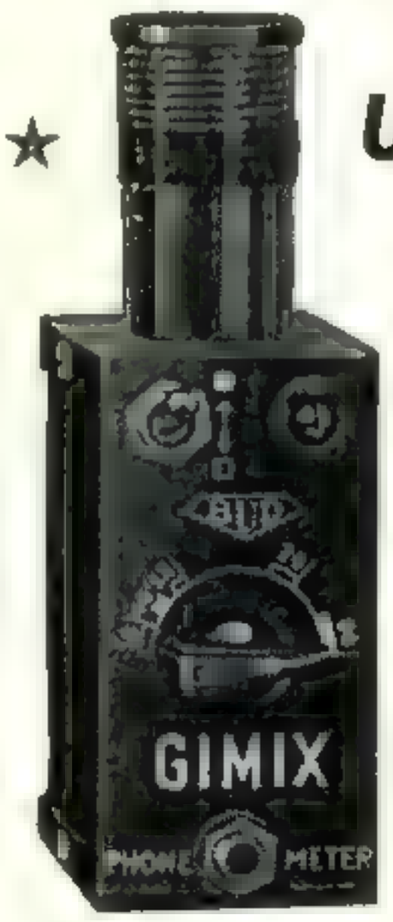
2. **Use as a Monitor.**
3. **Use as a Field Strength Meter.**
4. **Use as a Carrier Shift Indicator.**
5. **Use as a highly sensitive Neutralizing Instrument.**

★ 5 ★ USES



The BUD GX-79 has been designed and built with the true BUD quality and dependability. It is available at your local distributor, and we suggest that you contact him immediately so you will lose no time in getting the BUD GIMIX in your shack which is where it belongs.

DEALER NET $8.30

BUD

BUD RADIO, INC.

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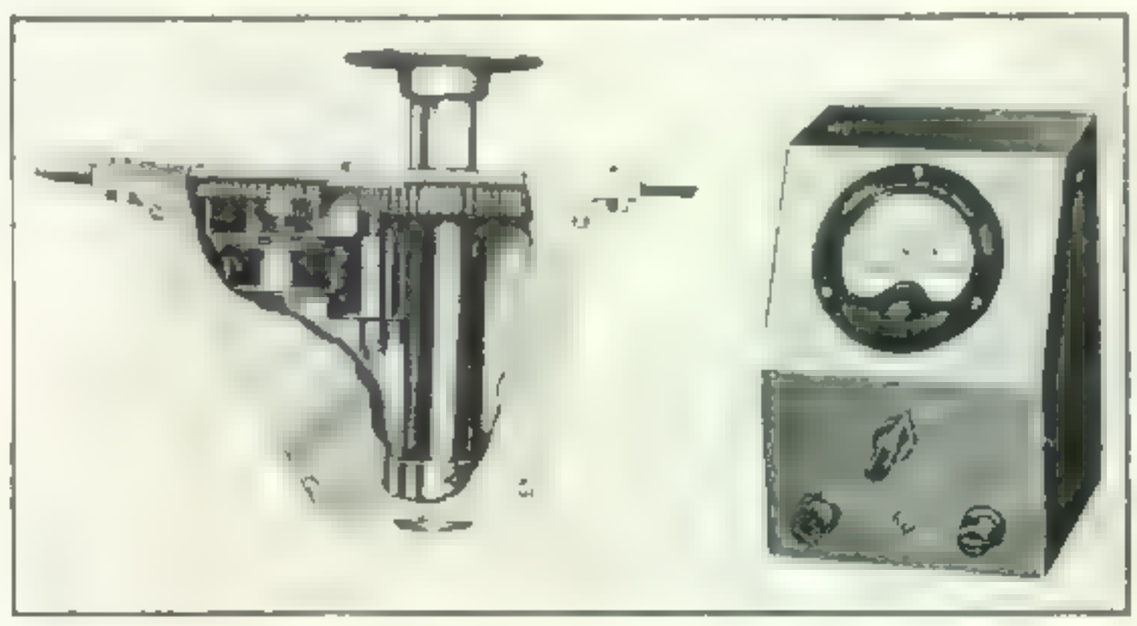
PARTS & PRODUCTS

(*from page 60*)

bination of durability, attractive satin chromium finish, and frequency response from 50-7500 c.p.s. Output level is -54 db. Polar pattern is non-directional at low frequencies becoming directional at higher frequencies. Model 905 employs high capacity, moisture-sealed crystal and is high impedance. Head is at a fixed tilt of 22°. Cable connector is built-in and the microphone comes equipped with shielded cable.

Beam Rotator

Rex L. Munger Co., Chicago, Ill., is manufacturing a medium priced beam rotator. Among the features of the Munger Electro-Beam Rotator are a 1 rpm rotating mechanism driven by a rugged high torque motor that reverses instantly from any direction; accurate direction indicator using potentiometer and meter system; heavy steel gears in compact shielded weatherproof case; lightweight and compact to simplify installation and permit use of small support. Operates from 115v. 60 cycle a.c.



5-Watt New Resistors

To supplement their Brown Devil line of 10 and 20-watt vitreous enameled wire-wound resistors, Ohmite Mfg. Co., 4952 Flournoy St., Chicago, has added a compact 5-watt size (5/16" x 1") which may be obtained from regular stock in resistance values from 1 to 10,000 ohms. Standard tolerance is ± 10%. The 5-watt resistors are of all-welded construction, and have 1½" copper wire leads. Bulletin No. 132 gives complete information.

New Literature

Concord Radio Corporation of Chicago and Atlanta announces the issue of a new catalog supplement, featuring revised 1947 prices on many items of interest to amateurs. The 72-page supplement lists thousands of items, many now available for the first time. A free copy of the new Concord Catalog supplement may be obtained by writing Concord Radio Corp., 901 West Jackson Blvd., Chicago 7, Ill., or 265 Peachtree St., Atlanta 3, Ga.

The Tube Department of Radio Corporation of America has just brought out a revised edition of the "Quick-Reference Chart on Miniature Tubes."

Covering RCA's line of 48 miniature types to date, this new edition features a functional classification of the various types; representative tube illustrations; and charted fundamental data, characteristics, text description, as well as socket-connection diagrams for each type.

A copy of the new chart, Form MNT-30A, may be obtained from RCA Tube Distributors.

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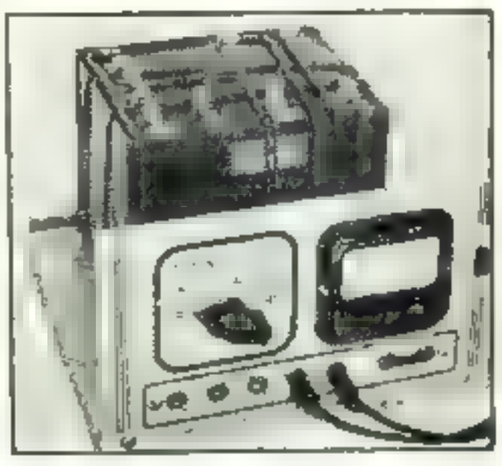

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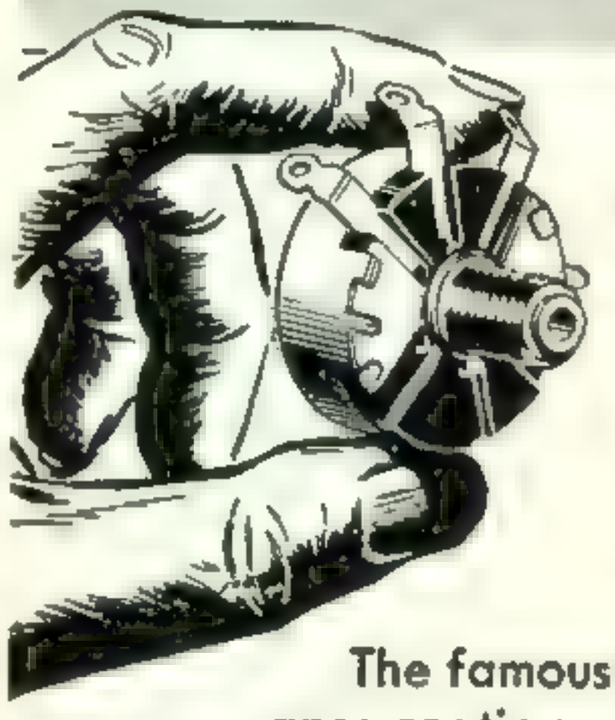

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DX

(from page 56)

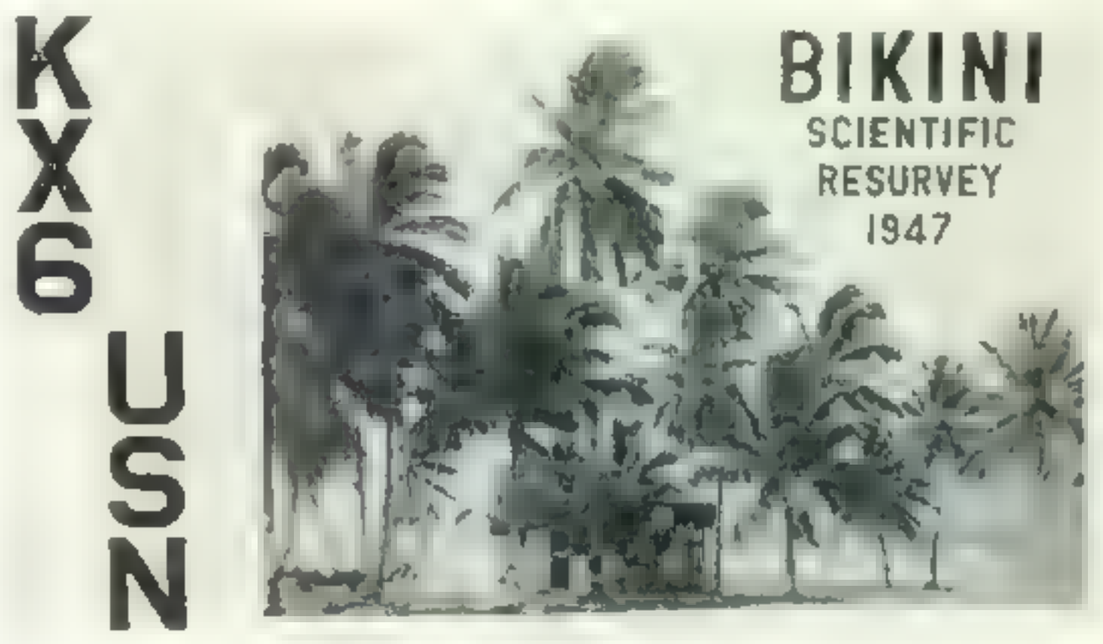
in Chicago (by the way, where are those other Chicago DX stations?) put the heat on *VS7DR* for a new zone. W9LNM says he had bugs in his rig and was off the air for a while, but even so, his DX looks something like 35Z and 105C. W9RBI, another one of those Wisconsin 9s, twisted LNM's arm until he sat down and made out a Zone and Country list to send in.

Ah, here's another Chicago W9—this time, W9TB. Wally has worked a flock a new stuff bringing him up to 82C. This, of course, is not a large total, but Wally didn't get back on the air until around the first of May of this year. Knowing this guy as I do, it won't be long now.

W2COK has now logged 150 countries with zones at 39. When he worked *ZC1AL*, he was told he was the only station presently active in Transjordan. He tells this to everyone he works, apparently, and I imagine it's true.

W2PUD, one of the Rochester Association boys, knocked off a few new ones such as *TF3MB*, *ZD3B*, *ET1IR*, *J9SIR*, and *ZB23*. This boosts Dick's totals to 33Z and 89C. It is good to hear from W2HHF again. He booms right into the Honor Roll with 39Z and 164C. W2PEO agrees that we should do a little less griping about the other guy in this dog-eat-dog DX situation. I think Eric is absolutely right when he says we may be taking DX too seriously, and there is not the same spirit that prevailed prewar.

W2BXA, our first postwar W.A.Z., adds a couple



of countries in *UL7BS* and *ZS3F*, making 40Z and 169C. WØGKS just finished a year of postwar DX, finding his zones at 39 and his countries at 128. D4ANM is trying to W.A.Z. before leaving Germany, as well as for 1000 QSOs. He, however, doubts that he will be able to drag in this amount of DX. He is hunting for some dope on *FY6LM*. This is the first report I have heard on this guy, and, accordingly, he doesnt sound too good to me. At present D4ANM has 34Z and 77C. Other new ones for W7FZA are *UH8AF*, *LX1AS*, *MD5DA* Egypt, *UD6KAA*, *YA3B*, *UI8AA*, *VQ5JTW*, and *MD1D*.

Tibet Workers of America Attention!

Some of the boys have been working a station signing AC4NR and/or AC4BR. To date, nothing points toward these stations being in Tibet, so until we know more about them, we are not crediting either of them. Received a nice list from ZS2X showing 40Z and 138C. At the time of writing the letter, he lacked only two confirmations for W.A.Z.

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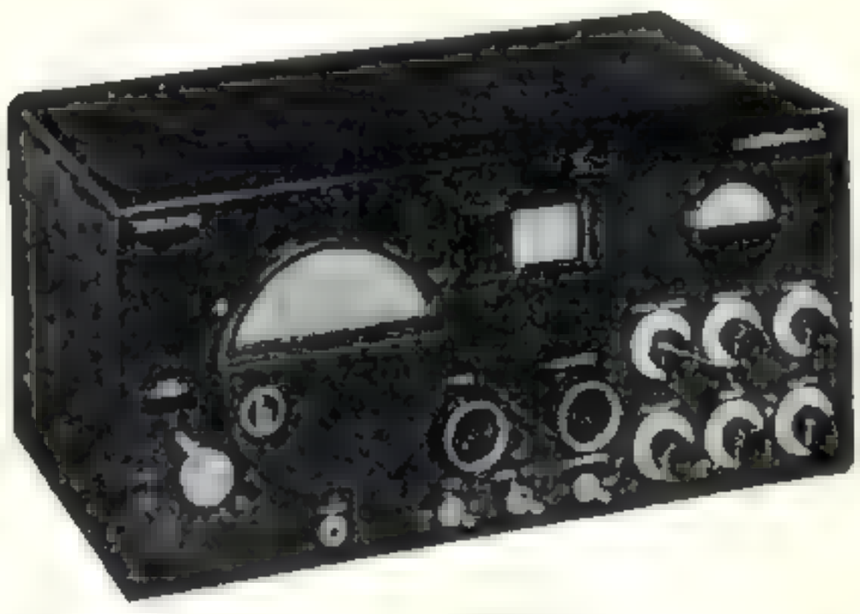

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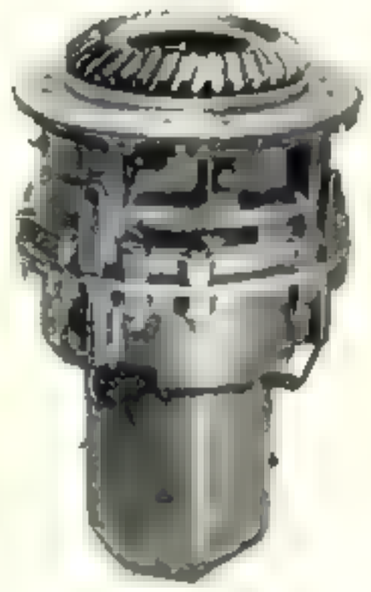

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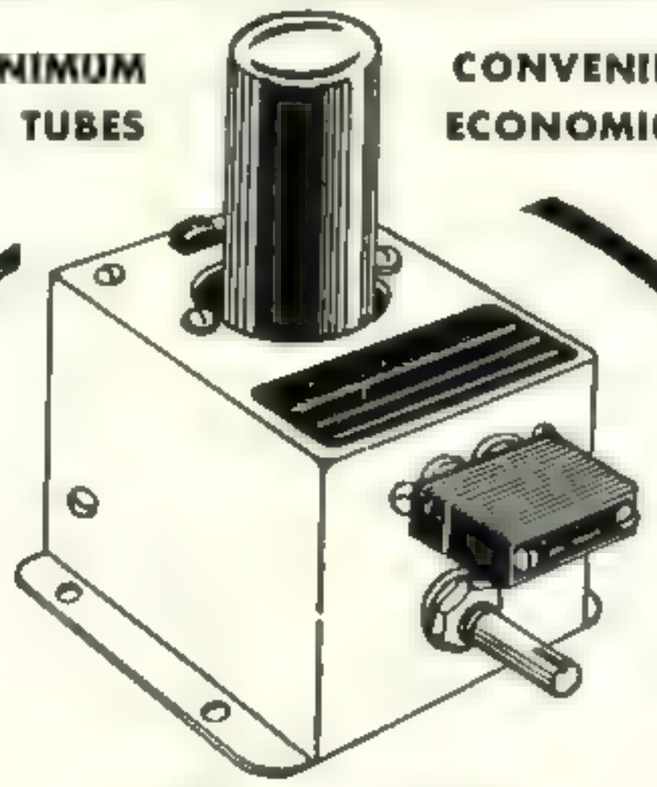

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and these from Zones 18 and 19. He should receive these any day, and he stands a good chance of being the first DX station to receive a W.A.Z. certificate. *ZS2X* spent two months on VQ8, and, as of the latter part of August, *VQ8AF* and *VQ8AD* were the only two active hams. Also, at the time of writing, he said there were no active hams on Madagascar. While visiting on VQ8, he heard that *FR8VX* of Reunion Island was killed in an air crash at the end of the war.

D4AVE just slides in the Honor Roll with 30Z and 60C. He has been on the air for only about five months, and, at this rate, he expects he will be in there pitching with the best of them. KP4KD connected with *UN1AO*, *CR6AI*, and *TI3SO*. This gives him 36Z and 110C.

By looking at the Honor Roll, you will notice W2GWE has 178 countries, which, my friend, is a lot of real estate. Pete is leading the Honor Roll in countries worked in spite of his TVI. W1KFV worked *YA3B*, *GD2FRN*, *W2WMV/C9* for his 116th country and 37th zone. Another W1—W1BIH, adds 2 new zones and 6 countries to make 37Z and 119C.

It is about time to hear from another W9, so we'll pick up W9IU. He says that from February of this year until the present time, he has worked more DX than he did altogether from 1925 to the beginning of the war. Les takes a good spot in the Honor Roll with 39Z and 143C.

Boy, what totals!! This time, W3BES breaks through with his list of 39Z and 172C. His latest include *YS1JR*, *YA3B*, and *AR1YL*.

W6HJP/WØ is moving his California kilowatt to the armory at the University of Minnesota. He expects to get into the DX swing again at that time. J9ABX said he was working *ZS6BW* who told him his power was 4 watts. J9ABX told him this was entirely too high and should cut it down. So, he did. He wound up using a Vibropak putting 100 volts on the plate of the final tube and drawing 7 ma. This was on 10 meters, and he was 5 and 8 at J9ABX. More power to him. Incidentally, J9ABX still hasn't worked a Russian but gets a lot of SWL cards from them. In addition to gunning for some of these Russian stations, he, of course, is laying for AC4YN.

W6WWW (no fooling, that's his call) told me W6KBH is leaving for Dhahran, Saudi Arabia, and feels quite certain he will be able to get on the air shortly after he arrives.

W6RM passes along a letter from *ZB1AF* who says that *ZB1L* has stopped working the States, because so many fellows were continually calling him without first waiting for the end of a QSO. This, and the abuse of the use of a v.f.o. are pretty good reasons.

Received word from *W6ODD/VP4* via W4INL giving some nice QTHs to be found at the end of the column. Some of these include *CR8AC*, *ZD1WB*, and *ET3Z*.

Those of you who have worked *OX3GD* shouldn't worry about receiving a QSL card from them. WØRMN, who was operating at OX3GD for several months, is now back in the States, and has ordered 1,000 QSL cards. He is going to send 800 of them to *OX3GD*, which is now being operated by W. A. Little. The balance will cover the contacts he made while there, and possibly by the time you are reading this you will have received your card. WØRMN, while in Greenland, was in the Frederiksdal C. G.

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Loran Radio station. Mailing address will be found in the QTH section.

W2BJ is about ready to get really fired up, and as soon as it cools off, he is going to put up his 10-20 beam. He bumped into W2AGW, a short time ago, who had just put up a 4-element beam, and is now going full blast.

W6ZZ has worked some new ones, such as *HS1SS*, *VS6AY*, *VR5PL*, and *PK1RI*. W4MZ is building up his DX score after moving to Arlington, Va. Some of his best include *J2AAQ*, *MD1D*, *UA1PA*, *I6USA*, *ZB1AC*, and *VP4TAI*. *W4HKJ/2* is operating low power, 40 watts to be exact, but has 11 zones and 22 countries. However, the going is apparently a little rugged, and when he returns to his home QTH in Miami, during September, he expects to get on with his 4-element beam, and a 500-watt rig. Something tells me he'll notice a difference.

WØSQO has some good ones tucked away, such as *PK6HR*, *CP1DD*, *EK1AA*, *I6USA*, *VR5PL*, and *VS2AL*. W6MX says that *MX3PA* is located in Kunsan, Korea . . . full QTH elsewhere.

W7BD is lacking three cards for his 40 zones. He is still using a wire, two wavelengths long, and he says the other boys can have their beams. He was one of the fellows to work *C8YR* in Zone 23. W8LEC is still doing O.K., and has added such stuff as *GD6IA*, *FK8NQ*, *CR6AI*, *VK9BI*, *UO5AD*, *W5LIV/J9*, and *W2WMV/C9*.

W6CEM bought a new typewriter ribbon and finally got around to making up his Zone and Country list. The Honor Roll will show him at 39Z and 119C, although he has worked all the zones. He is not sure, but he needs one or two confirmations.

CP1AT says that he has been operating as *CP1DD*, however, this latter call was previously held by another fellow, and therefore, the QTH as listed in previous books is not correct. The correct QTH now for CP1AT, as well as CP1DD, which he had been using previously is: 935 Hermanos Manchego, La Paz, Bolivia. Bob's transmitter consists of a 6V6 into an 807, and his receiver is a Super-pro. CP1AT is out for W.A.S., W.A.C., W.A.Z., and DXCC. Send cards undercover!

W4MZ is doing all right for himself for the short time he has been on, as he now has 27Z and 50C. If he stays put in this QTH long enough, he will get in the Honor Roll yet. W4BPD wants any of the West Coast gang who happen to next work *AC4YN* to ask him to listen for the East Coasters around 0000 g.m.t. and 1200 g.m.t. Gus has sent in quite an imposing list of DX worked, some of the best ones seem to be *TA1AD*, *EP2DS*, *ZD6DT*, and *HZ2FI*. He and some of the other boys have heard a station sign *AC4BR*, however, we have no dope on this guy. W3LVJ (ex-W2LMN) is working under a double handicap to get what DX he can. In the first place, he lives in an apartment house in Washington, D. C. The ignition noise is almost a steady S6 to 7. He has about 130' of feeders, and he is only running 60 watts to an 807, yet the guy has 25 zones and 50 countries. He is working on a new 500-watt final which will use a pair of 8005s.

W2IOP says *I6USA* would like to have the gang look for him on 28,400-kc. phone. W6ZCY is an old-timer back on the air with a new call, and is one of the lucky ones to have worked AC4YN. Although he hasn't had time to send in his list, he has worked 40Z and 117C; all this in five months time. He had been off the air for 15 years, previously holding

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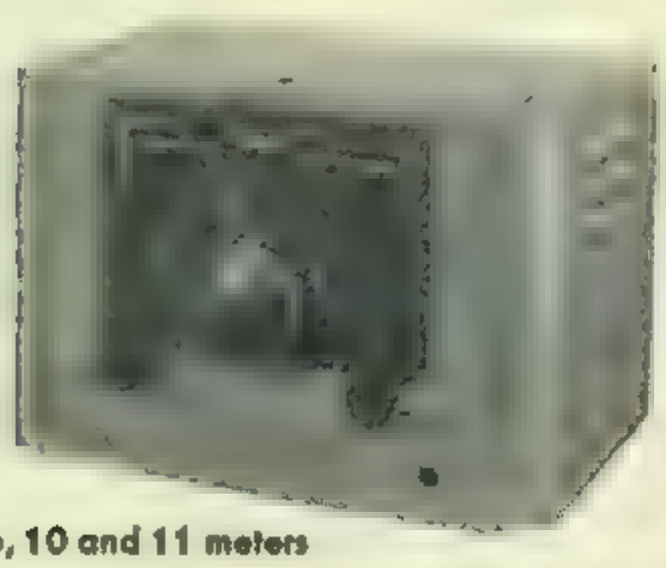

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W6BQR. That's a lot of DX in five months.

W6IKQ adds a few new ones on 20 phone; *FG8AB*, *ZD6DT*, *J8AAB*, *VQ8AF*, *HR1JV*, and *VQ2HC*.

It was good seeing W1DX and family out here on their vacation. A get-together was had at W6CHE's and of course one subject of conversation was "What is a country?" The varied explanations from all certainly didn't clarify things with the result everyone wound up highly confused—mostly from above pow-wow, that is. I'm sure By will be able to concentrate better in the peace and quiet of Connecticut.

Ship Stations N. G.

W6UZX adds *VP5FR*, *VQ5JTW*, and *EQ2L*; the latter giving him his 39th zone. W6AM says they are still rolling in at Rolling Hills, Some of his latest and best are *UB5BD*, *UQ2AB*, *UAØOA*, and *UAØKFC*. W6KRI finally found enough time to compile a nice neat Zone and Country list. He breaks right into the big money in the Honor Roll with 39C and 144Z: W6KRI has worked 167C all time. While we are in the sixth district, we may as well clean them up. Next we'll pick on W6ADP who now has 39Z and 142Z. Those helping to give him this are *UI8AA*, *CR6AI*, *W8WEA/TRUK*, and *UD6AB* . . . Glenn's all time is 167C. W6SN is up to 139C after knocking off *G2DF/GD*, *GC4LI*, *LU1ZA*, *VP8AI*, *PK5LK*, and *LI2B*. I might mention here and now that many of you have probably hear *LI2B*, which was the Kon-Tiki expedition on a raft drifting toward Tahiti. Obviously, the station on the raft does not count, however, after arriving at Tahiti, *LI2B* was operated ashore.

W6ENV, one of our hard working DX committee members, seems to have enough time outside of checking Zone and Country lists to boost his countries to 156. Those who Andy slaved the hardest to get include *UH8AA*, *UI8AA*, *UJ8AD*, *CR6AI*, and *GD2FRV*. Of course, he has worked others, such as, *C8YR* in Zone 23, *UR2KAA*, *MD1D*, and *LU1ZA*. He has worked all 40, but remains at 39 in the Honor Roll until all confirmations are submitted.

W9YNB is a little disgusted with trying to battle the mess of QRM which piles up on new DX stations, so is giving up serious effort to add new ones. Instead, he tosses out a CQ DX, now and then, and usually works someone needing a W9 (Ah, yes, those 9s!) or Wisconsin.

Up Detroit way, W8LEC had enough time outside of his F.C.C. duties to grab four new ones including *TA3SO*. This makes Dick's totals 39Z and 146C. W8NBK has been trying for years to get Zone 18, when, bingo, he gets three the same day: this boosts him to 38Z and 132C. W6ZZ grabbed off ZE2JI for number 84.

Phone Gossip

W2HY has grabbed *J9CRP*, *KG6AV/VK9*, *CT2AB*, and *MB9AJ*, making 32Z and 77C. W8REU is a new one with us with 35Z and 104C. Another one we are glad to see is G6BW with his list of 32Z and 69C. W2DYR worked *HZ1AB* the first night he went on phone. W6DI, another one of our DX committee, was moaning about not being able to work any new ones on phone, when up pops three for him: *VP5FR*, *XAMC* in Trieste, and *VP7NH*. This stuff gives W6DI 37Z and 118C. W6PXH adds *OI2KAJ*, *VR3A* on Washington Island, and *VP7NH*. It's now 31Z and 82C.

Evidently, just because a fellow is W.A.Z. is no reason for him to quit this DX business, because W6VFR, for example, picks up *ZC1AL* and *VR3A*,

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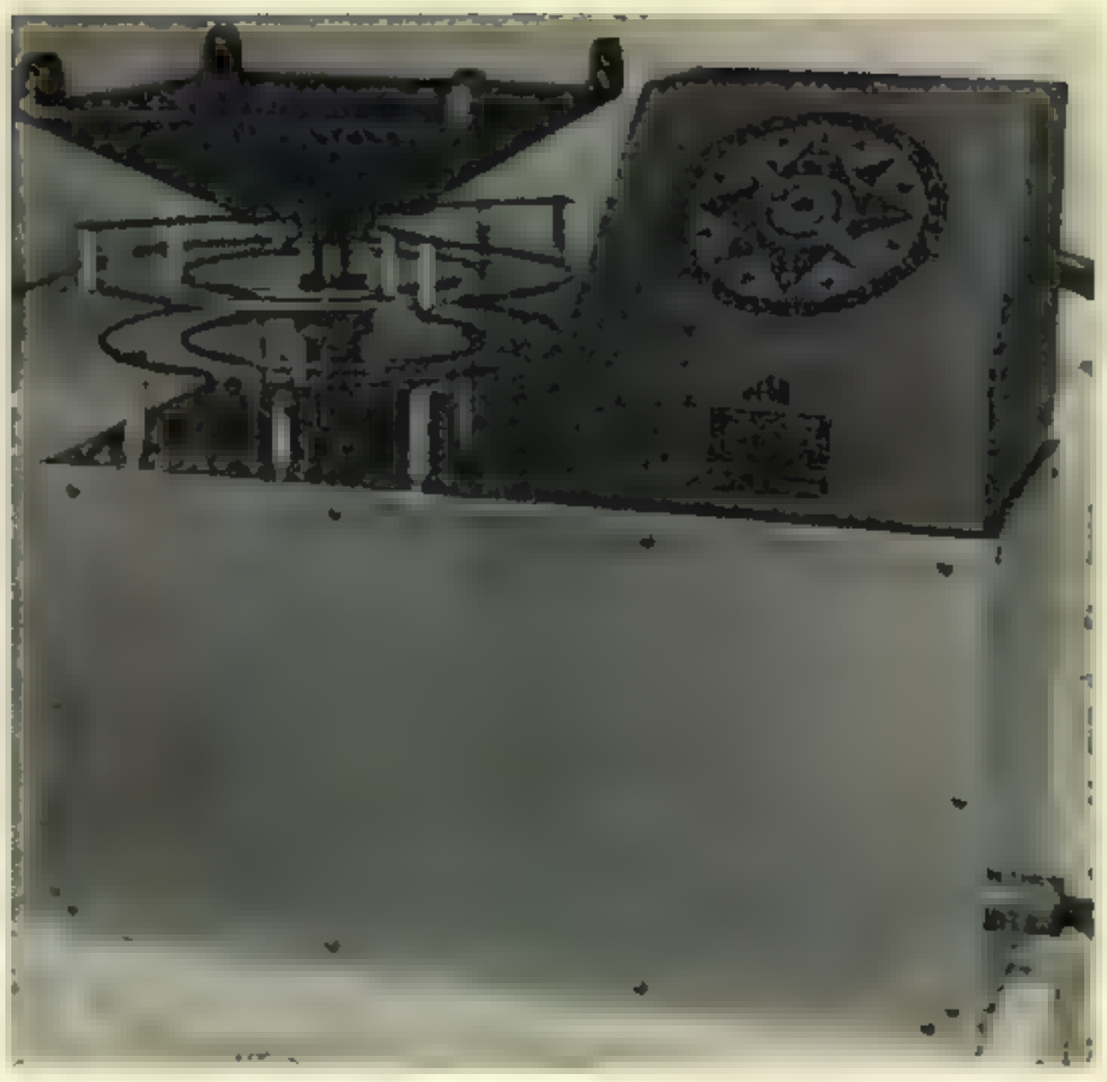
The control unit contains the selsyn receiver, engraved azimuth dial, double pointer for dual arrays, on-off switch, and pilot lamp, and switch to reverse direction of beam rotation. The speed of rotation is supplied at one r.p.m., but may be adjusted by changing taps on the motor transformer. The entire system operates from 115 v. a.c. line with a power consumption of approximately 100 watts when driving a large array. For full details and descriptive literature write to Henry J. Howard Co.



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his totals looking something like 40Z and 168C. Right in the same groove is W6PFD with six new ones pushing his countries to 158 . . . zones, of course, stay at 40.

W2LTP says he is getting a lot of QSL cards for *EL5B*. He would like to have the boys be patient, as EL5B will definitely stop there when he arrives in the States. In the meantime, if you have worked EL5B, you can send your card to him c/o W2LTP, 401 Rahway Avenue, Elizabeth, N. J. W6LRU would like to see more emphasis on the guy who doesn't run a kilowatt, rather than having all the laurels going to the high-power boys. Well, ... er . . . . . ah, that is . . . . . well . . . . . heck, you know how it is . . . . .

Here And There

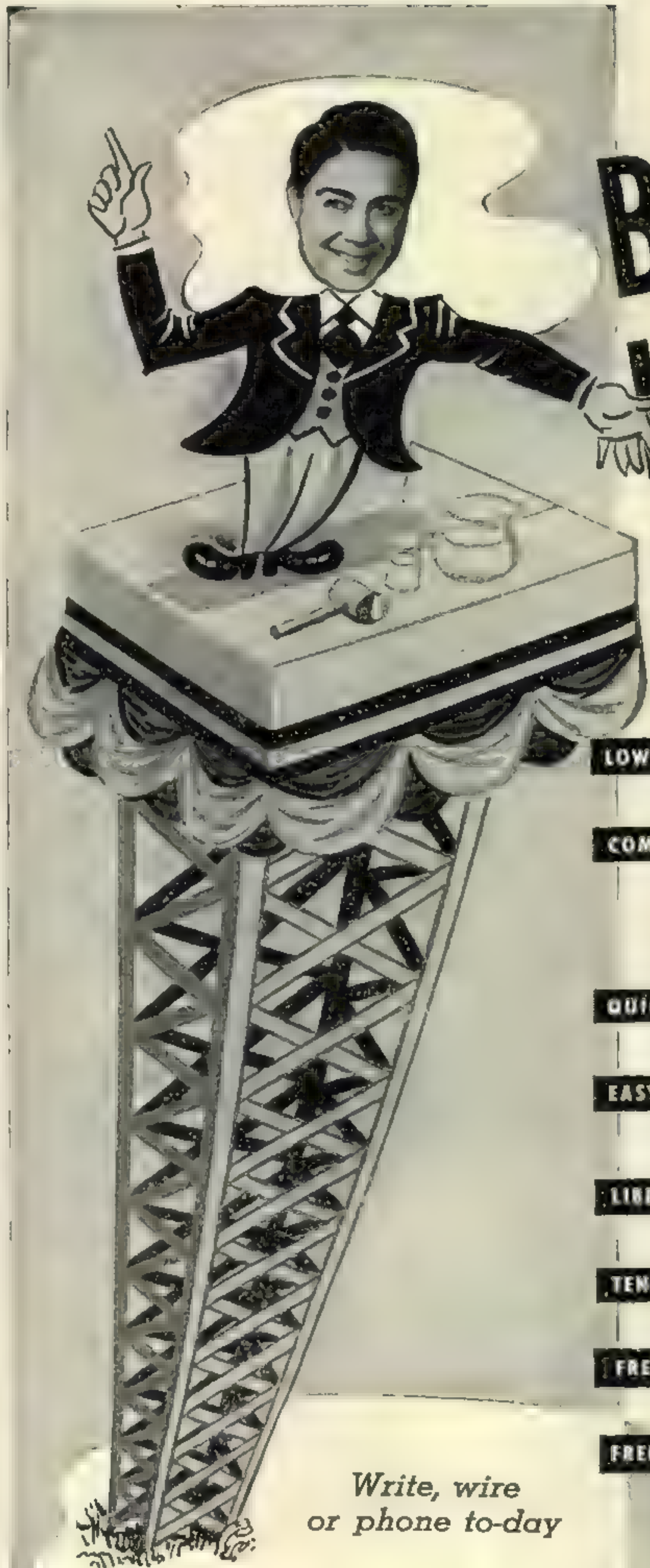
Charlie Perrine, W6CUH, dropped in on his vacation out here, a few weeks ago, and although the guy hasn't been on the air in years, we did manage to kick the DX subject around a little. He is in charge of a pretty fair size project back on Long Island.

Cards from several of the Zone 19 boys have been arriving, as well as *HS1LN*. W2IOP is still trying to confuse me on the Christmas Island situation. As far as the DX committee is concerned, when he works a VR3 on it, he'll get credit for it. He's off the air moving to a new QTH so guess we won't hear from him for a while, but just wait . . .

Well, it looks like the band is going out, so I'll pull the switch, and see you next month on the low end. 73.

QTHs

AR8AB	P. O. Box 293, Beyrouth, Lebanon
EP2BU	P. O. Box 7, Schiras, Persia
GD2DF/A	(ex-G2DF) Fred Yost, c/o Ronaldsway Airport, Isle of Man
HK3CK	Box 584, Bogota, Columbia
14LL	P. O. Box 83N, Cagliari, Sardinia
LI1A	Via R,S.G.B.
MD1E)	c/o Signals, RAF El Adem, Cyrenaica,
MD1F)	MEF 7
NY4ZQ	Navy 115, c/o F.P.O., New York, New York
PK2RK	Radio P.T.T., Solo, Java
PK6SA	Biak, Box 76, Macassar, N. E.I.
PK6WS	Sgt. Ronkes, A.A.C.S., Biak Island N.E.I.
SV1AH	Box 255, Athens, Greece
SV1TA	59 Anakreontos Street, Kallithea, Athens
TF3MB	Box 1080, Reykjavik
TI2JE	Box 454, San Jose, Costa Rica
VK9BW	W. Holland, Kokopo, Via Rabaul, New Guinea
VR3A	Washington Island, North Pacific
VP4TAD	Cornelia Street, Port of Spain, Trinidad
VP4TT	73 AACS Group, APO 869, c/o P.M. Miami, Florida
VQ2DH	D. C. Hilton, Box 93, Livingston, N. Rhodesia
VQ5WCP	W. C. Puttick, P. & T. Dept., Kampala, Uganda
VS1AQ	Capt. L. K. Ayer, Engineer Branch, GHQ, SEALF, GPO, Singapore
VS6AA	Returning to England. QSL via G2MI
XZ2AG	64th Brigade Sigs., Maymyo, Burma
YN4DT	Bilwaskarma, Nicaragua
ZE2JN	Box 225, Bulawayo, Southern Rhodesia
ZC6BB	Via R.S.G.B.
ZS6FN	Box 7243, Johannesburg



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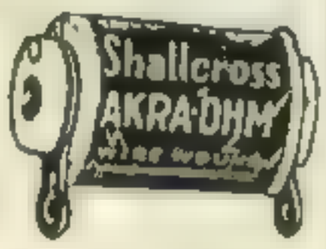

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V.H.F.—U.H.F.

(from page 49)

W5VY works LU9EV on 6!

W5VY (ex-W5EHM), San Antonio, Texas, worked LU9EV on 6-meter c.w. Oct. 12th, 1500 CST. When mileages are checked this will probably be a new record. LU9EV has worked 7 countries on 6 meters and has heard W8ZVY on 6-meter phone. Full details next month.

W7ACS/KH6 works the U. S.

W7ACS/KH6 on Oct 12 from 1520 MST on 50 mc. worked W7QAP, 7OWX, W5VY, W6OVK, BOS, JRM., KD, OB, QG, NAW, UXN, BWG, TBS, WRJ and OHM.

back East on six. His travels included all the larger cities throughout the East but nary a signal heard, except those worked on Es while in South Carolina. Perhaps the trouble was antenna polarization, Wilmer, verticals are practically non-existent in the East, while before the war verticals were predominant on 5 meters.

The Los Angeles lads are a bit unhappy about no publicity and have appointed various brothers to gather the news from the various bands and report to W6FMO, who then sees that it gets to the proper parties. The first report is an FB one and gives news on new 6-meter stations. Perhaps other areas could benefit from this way of reporting activity.

San Diego is represented by W6KD, WNN, APG and a new one, W6IV. In Santa Barbara we find W6AMD, TMI and QFT in Ventura, fairly active. W6OB and W6HPP in Compton, along with W6AOR-W6YRL are heard frequently. Other solid customers are W6ON in Baldwin Park, W6NXJ at Whittier, W6OJV at Long Beach, W6VXJ in Pasadena and W6AOP in El Sereno. W6ZBZ/6 at Oat Mountain has a new call for his fire look-out station, being W6ACR. W6LX in Alhambra has returned to six after an absence of some time. Also welcomed back is W6AH in Wilmar. The Lec Net is on their spot frequency but leave after their meetings, so no outside contacts. Overheard were W6CMQ, FGS, LWX all working W6MP/6 while portable on Mt. Woodson, near San Diego. The Tel Rac Net gets together now and then, and it is rumored that W6TD in Covina is going East to the Bell Labs for a while. The gang wishes him good luck. Back on after an absence of several weeks is W6GZZ. The old "high-power" boys of the 50-mc DX season just past have left for other bands as they can't be heard any more. W6LF and his buttermilk gang have been heard. If it's true you fellows stay up to 0200 out there, why not join the dawn patrol of W3QKI? A new record may be your virtuous reward. What was once a Collins MBF stronghold in the LA area has given way to 522s and higher-power rigs.

W9CBJ, of ex-56 mc, visited the Illinois gang and while at WØHAQ's shack the gang threw a rig together with an 829B final, in one day, boss foreman being none other than Mr. Zearing of Greybill, Ill. W9CBJ will be on at his new QTH in Jacksonville, Fla.

In Kentucky, W4JML says the band just dried up for skip contacts, although while on vacation in the East he visited some of the well-known W1s and operated W1AW on 52 mc. Jim has 20 states and lacks the 6th district for WACA. He is saved by good ground-wave contacts with the gang in Ohio, Ind., Tenn. and Ky., so he guesses he will get started on 144 mc.

Ed O'Neill, W1CLH, in Bridgeport, Conn., has 29 states and 8 call areas, and advises that on Labor Day the third harmonic arrived, but he must be in a rut as they are all boys.

W7ACD, Louie Cox, has a new shiny VHF-152A, but complains also that skip hasn't been in to let him try it. He mentions that W6ANN and WØNFM visited him while on their vacations.

Harry Miller, W9AB, has a new converter for six which has 2-6AK5s r.f., 6AK5 mixer and 9002 oscillator. The first stage is an R9er type with broad-band slug-tuned coupling between stages. The oscillator has the only variable-tuned circuit. Now if the band will only give Harry a chance to try it, he will be happy.

In Alberquerque, W5ELL spent most of last month out of town so missed what few openings occured. Before long Ed hopes to have converters covering 30-50 mc and 54-60 mc to see what happens. W5ELL's standing is now 29 states, VE7, XE1 and he lacks only the 3rd dist.

After Oct. 1st Bill Carley, W4WMI, will be back in Raleigh. His operation in Georgetown, Ky., has netted him 33 states and WACA, against 29 states and 9CA from the Raleigh location.

(QSY to 76)

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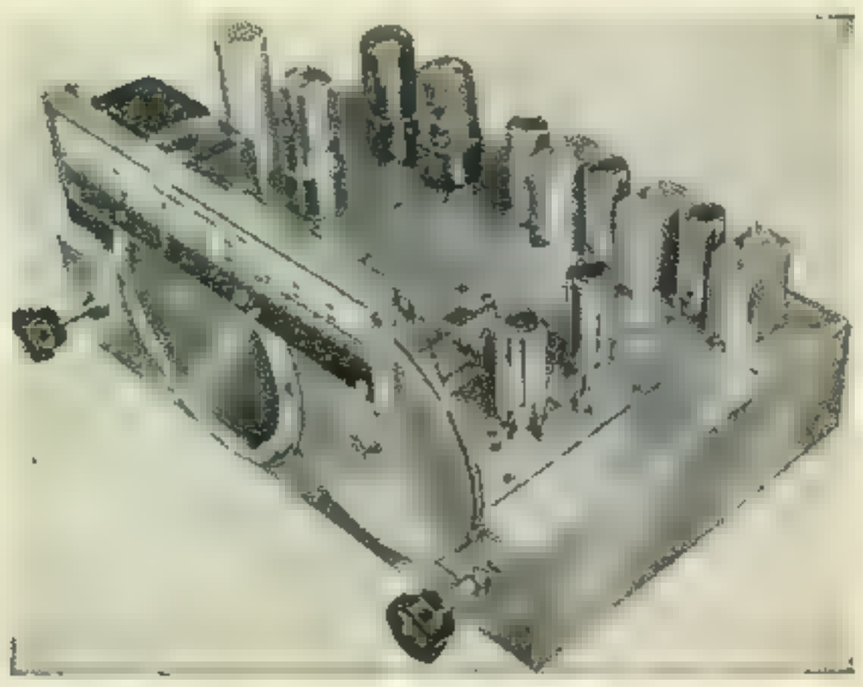
covering the entire F.M. Band
(87.5 to 108.5 mc)



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- Complete with wired Transvision FMF-1 turner front end and Transvision FM 107R IF Amplifier, 10" PM speaker and a matched set of 8 tubes: (3-6AK5, 1-6C4, 1-6V6, 1-5V3, 1-6AL5, 1-6SN7).
- All component parts are of the highest quality.
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Beautiful furniture-finish cabinet available at low additional cost.

ALSO . . . BASIC ESSENTIAL PARTS of the TRANSVISION 8-tube F.M. Radio Receiver available separately.

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144 mc and Above

Last month we mentioned the incident in which a tower operator in Houston, Tex., contacted a plane over Shanghai, China, on 130.3 mc. A letter from W5KWZ, ex-W9QNC, from Kansas City, gives us more info on the matter, since he was the operator who talked to the plane.

Jim, W5KWZ, is tower op for Braniff Airlines at Houston. About 1820 CST on July 20th he heard a ship calling the Shanghai tower. Jim called him and advised him he was in Houston, Texas. The pilot came back and said he was Indian National Airways Trip 46, and gave his altitude in kilometers, a repeat was asked for in feet and the pilot said he was at 1000 feet and flying a "Dakota," or American type DC3, and he was reading Houston 5 by 5 (S-9). The contact was not heard long as the ship was circling for landing instructions, but was heard a few minutes later by Jim, to tell Shanghai tower that he was working the "good old United States". The pilot was evidently English as he would end each transmission with, "Go ahead, old man." Jim has written the airline at New Delhi requesting more information from the pilot, which will be forwarded to us.

As mentioned before, the 2-meter band has enticed lots of the 6-meter gang to give the band a whirl, because of the openings that have been occuring. Good openings have been repeated between the Wisconsin and Illinois areas to Michigan, Ohio and W. Pa. Sometimes cross polarization between vertical and horizontally polarized stations have occured, but on most of these western openings the horizontals have produced better signals. While some of the lower-powered stations with 522s have made the grade, those with additional finals with 100-500 watts have produced the best signals.

Perhaps the success the 144-mc band is enjoying is because the 522 is available on the surplus market which makes a nice low-powered xtal rig, or as an exciter for a higher-powered final. Several receivers such as the 1063A, ARR-5, 522 and the RME VHF-152A converter have given the band quite a boost, but as usual there are those who take the band seriously and go in for a good home-built job that shows the v-h-f man's ingenuity for experimenting and developing.

On August 8, around 2300 EDT, W3GV in Erie, Pa., picked up W8WXV in Mansfield, Ohio, a distance of 140 miles, who was in contact with W9BBU of Elgin, Ill. W8WXV asked W9BBU to stand by and he would get W3GV to look for him. W3GV, after looking for W9BBU for ten minutes, told W8WXV he wasn't hearing him as an S-9 plus signal near the W9's freq. was taking him out. Finally W3GV tuned on the 9 plus signal to find out who it was that was so loud, and lo and behold, it was W9BBU!!! The signal was so loud that Bliley thought it was a local, and never bothered to stay on his carrier long enough to identify the terrific signal. A very good contact of 20 minutes resulted, with S-9 plus signals at both ends. Upon signing with W9BBU, W3GV was being called by literally every station on in Illinois. The following stations were worked between 0030 and 0200 EST: W8HDM, Kalamazoo, Mich; W8DIV, Pontiac, Mich; W8AKR, Breedsville, Mich; W9IPO, Chicago; W9GGH, Kenosha, Wisc; W9MTC, Libertyville, Ill; W9IOD, Elmhurst, Ill; W9WOK, Bensonville, Ill; W8CVQ, Kalamazoo, Mich. Stations heard were: W9AGV, Rockford, Ill. and W9ZHB, Greybille, Ill. The farthest station heard was W9ZHB at 480 miles. W9IPO and W9BBU tried unsuccessfully to hook WØHAQ in Davenport, Ia., up with W3GV, but neither station heard the other.

August 26th, W3GV, heard briefly around midnight W9GGH, IPO and BBU, but could not raise them. W3GV adds that W3HWN, Mechanicsburg, Pa., has completed the link that connects the Atlantic Coast with the Great Lakes by putting up a horizontal antenna and the first night raised W3RUE in Pittsburgh and W8WJC.

During the opening on Aug, 8th, W3GV says the inversion area seemed to be about 500 miles long, and 100 miles wide. Stations which were very loud in Erie, from Illinois, were often not heard at all by stations in between the path. *(QSY to 78)*

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110V Pri: 60 cy, Sec: 4000 V at 10MA. Size 6 x 4 x 3½

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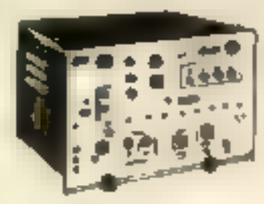
Approximately 65 MMFD cond., coils, RF chokes, dials, assorted mica condensers, 2500 WVDC. Over $50.00 in parts!



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Condensers

Cap. MFD	Working Volt	Your Cost
1	1000 oil	44c
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110V, 60 Cy. Pri. Sec: 255V ea. side of center at 80 Ma, 5V at 4 Amps, 6 3V at 3 8 Amps. Hermatically sealed

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OPER. ON 6-12 OR 24V.
FREQ. RANGE, 2.5-6.5 MC
5⅜ x 6¼ x 4⅛ - WT 6 LBS.

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3 lbs. assorted hardware $1.00

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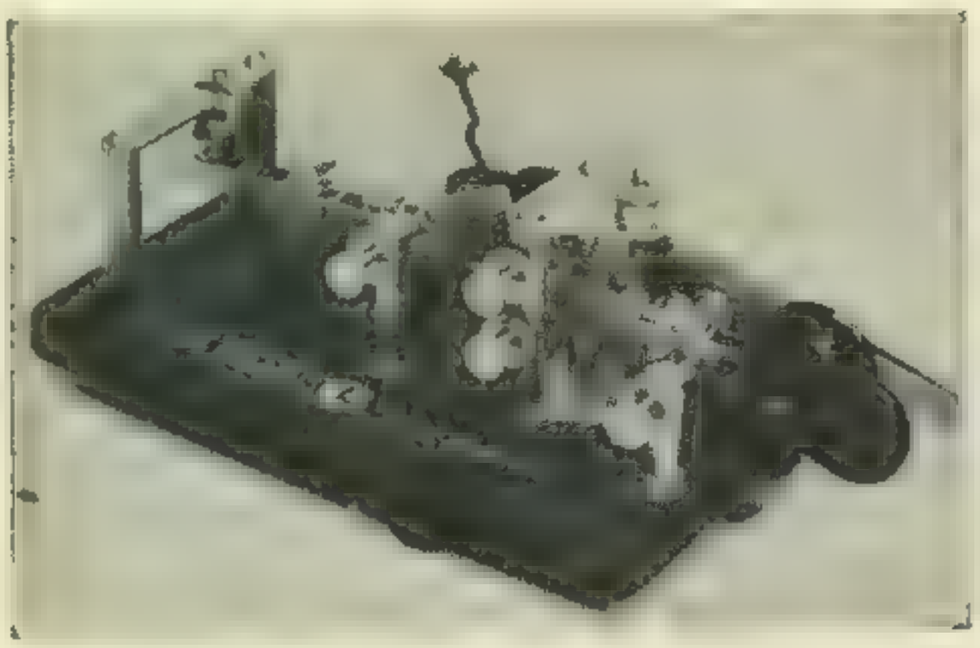

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The night of September 17th into the wee hours of the 18th brought another super-refraction that set a new record and got the Iowa lads into W. Pa.

WØNFM, Clair Brown, at Solon, Ia., south of Cedar Rapids, had a field day working W8UKS, W8YGM, W2GBK, W3GV, W8VVY and W2TTW/2.

On the 17th when WØNFM was working the DX, he took time out to call WØYUQ on long distance phone so that another try for a record could be made. Altho WØYUQ-WØZJB spent a whole evening listening, nothing was heard, yet the equipment is 175 watts to a pair of HK-24Gs, excited by a 522, a VHF-152A into an NC-173, 12-element H, and a 72-element square corner reflector. The "ducts" just weren't flying low enough that night.

VE3ADO, in Toronto, along with brother Ws have made some rather nice tests on 144 mc, just to see with what regularity contacts could be made to the following areas: Toronto, Hamilton, Pt. Colborne, Buffalo, Westfield, Erie, Cleveland, Mansfield and Detroit. His list shows 60 some odd contacts with these areas from June 20th to July 24th, and to make it legit he incorporated a microammeter in the a-v-c line and calibrated it to give 1-5 microvolts reading with reference to the input voltage of the receiver, a BC1063A. Repeated contacts were made over 120 miles to 200 miles, with readings as high as 2 microvolts from W3GV at 120 miles. Unfortunately, space this month prevents us from giving you the list with mileages and microvolt readings, but perhaps next month it can be done.

W7DLR and W7SP have broken down the jinx by working from Ogden to Salt Lake City on 144 mc. The distance is 40 miles, but over very rough and high terrain. W7DLR uses a 6-element beam and 522 receiver and transmitter. W7SP was using pair of 75Ts, xtal, with 16-element beam and S-37A receiver. The boys would like skeds with Provo and Logan to try to extend the coverage.

Other reports reaching us are that W2LVQ in N.Y.C. heard W4HPU in Raleigh, N. C., and a station in Columbus, Ohio. New Jersey stations have heard W8ICL in Ohio come through which shows the band is getting hot. The bootlegging of calls on 2 meters is becoming serious in the Eastern areas. For instance, a W5TKA has worked a few fellows around the 2nd district and some W4s in Georgia and North Carolina, but all were bootleg, which makes the gang skeptical of DX calls. At any rate it will pay you fellows to call any DX station heard, as on the ole 56-mc band in the late 30s this held back some good work. Of course, you should trace them down if you can, but make the contact first, just in case it is DX !!!

Ed Gessert, W5ELL, in Albuerquerque, says that there is some activity there now, and that W5LFH received a heard report from New England, on 144 mc. The layout at W5ELL is an 829B driven by a 522 with 75 watts, feeding a 6-element vertical beam, and a ground plane as a spare. The receiver is a two-stage lighthouse grounded-grid amplifier ahead of a VHF-152 to an HQ-129X.

W4BYR in Tampa says that the following are on 144 mc in the Miami area; W4FLH, FVW, VV, KMM, BI, KKU, LIP, DUW, HBF, ITE. In St. Petersburg; W4FPC, KQR, HUY, LSK, LPC, GGJ. In Tampa; EEW, LLP, DES, ALP, KKS, BYR. The Tampa-St. Pete contacts are still 100%, but tests with Miami have been nil. The Miami gang is 100% xtal control and the other areas are going over to the 522s and ARC-3s. Tests have shown the ARC-3 receiver to be superior to the 522.

W1HDQ says that the tropospheric stuff is simply terrific as he really got a jolt when VE1QZ came romping through S7-9 for several hours, a distance of 480 miles. The best contact for VE1QZ was to W1OSQ, 520 miles, on Aug. 27th. Ed also mentions

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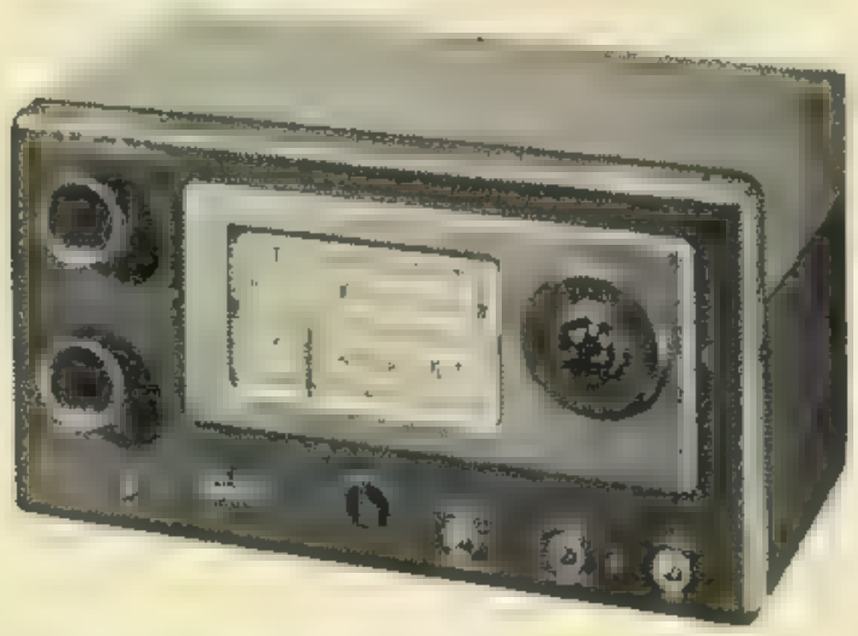

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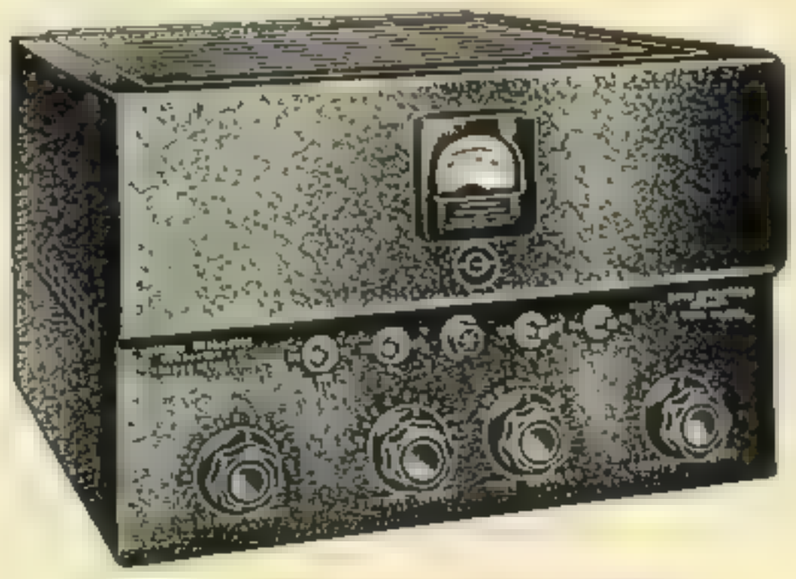

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C21020.....Your Cost **$92.80**

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Small compact transmitter for 10 and 11 meter operation. Uses any type power supply. Can be installed in any vehicle, boat or airplane. Also used for fixed station or as driver for high power final. Direct crystal control. VFO may be used in place of Crystal. Frequency deviation adjustable from 2 to 3 KC. Power output approx. 22.5 watts. In gray case 10 1/8 x 7 x 5". Shpg. Wt. 20 lbs. Complete with tubes but less crystal and power supply. Also available for 6 meter operation on special order.
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that interest is stirring on 235 mc and 420 mc. Well, it takes a smaller duct the higher in frequency you go, so there are some mighty good bands just waiting for a new record.

From W. Va., in Charleston, W8YIF gives us the info on the gang there, with these stations active: W8BKI, LYG, YIF, CSF, SHU, ZJS, HBB, CHP, HI. Most are using modulated oscillators or MOPA but are planning on going to xtal control with the 522s and ARC-3s. The gang in Charleston are on Saturday and Sunday evenings. A recent v-h-f contest sponsored by the Kanawha Valley Club was won by W8YIF who used an HY-75 osc. into a 920B and 6AK5-955 t.r.f. super-regn. No DX is mentioned, but they are eager for outlying cities to arrange skeds with them through W8YIF.

How about you 144-mc gang giving us your states worked. We would like to start the 144-mc Honor Roll now that states worked are getting high. Who is the leading states-worked station? Drop us a card with your score and we shall find out.

Microwave transmission between the Great Blue Hills, Canton, Mass., and Mount Wachusetts, Princeton, Mass., was accomplished on 2350 and 2375 mc, a distance of 45 miles by W1ILS and W1JSM, the QSO was held amidst throngs and Model-T QRM for 2 hours. No static or fading was encountered and the power output was 100 milliwatts!!! The antennas were two-foot parabolas. A great day was had and the boys are proudly exhibiting the log books, with witnesses signatures from afar.

That is it for another month and thanks for the reports. Next month the column will be done under different circumstances, as we have been called to active duty with the Army Air Forces in our old outfit, the AACS. If Army slang comes forth, it will seem like old times. Send reports to the same QTH as they will be forwarded. 73 and CU on 144 mc.

THE YL'S FREQUENCY

(from page 58)

"As for myself," Iris writes, "I am a housewife. I became interested in ham radio about six years ago—my husband was a ham, W9AKX—and I received my license in '42. During the war I was an instructor in code and radio operating (tactical procedure) at the Sioux Falls Army Air Base.

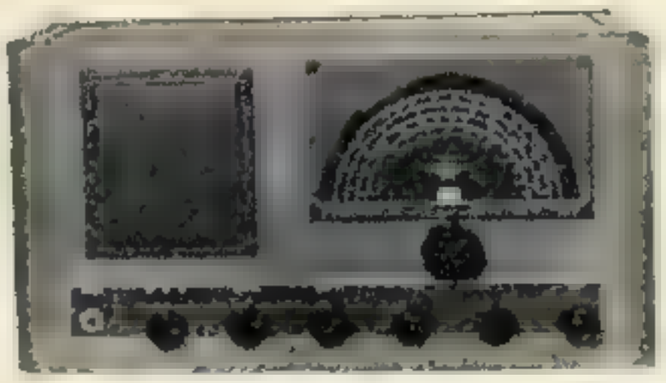
"I operate on 10 meters exclusively. Haven't been very active this summer for my family (I have a daughter thirteen years old and a son eleven), household duties and canning have occupied most of my time, but I intend to do a lot of hamming this fall and winter. We have quite a lot of old-time hams in our club so I feel quite honored that they elected me their president."

FB, Iris, but we'll have to disillusion the OMs in your club, for we know of at least one other YL ham club president—Eunice Randall, W1MPP, who is president of the Eastern Massachusetts Amateur Radio Assn., a very active club numbering 271 paid members. Eunice has a fascinating background in ham radio that would make any one of us newcomers envious, going way back to 1917 when she was one of the operators of experimental station 1XE in Boston. But we'll give you all the interesting details in a YL of the Month write-up in the near future. *(QSY to page 82)*

ARROW HAS RECEIVERS

NATIONAL

HRO-7T	$311.36
NC2-40DT	$225.00 Less spkr.
NC 173	$179.50 Less spkr.
NC 46	$ 97.50 Less spkr.



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RME 45	$198.70
RME 84	$ 98.70
VHF 152A	$ 86.60
DB 22A	$ 66.00

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of unsurpassed service to the radioman. Parts accessories, equipment or advice, Arrow's men stand ready to serve you promptly and efficiently. Arrow has a policy of mail order that insures prompt delivery and quick service. All mail orders are filled and sent in four hours after receipt. Five dollars deposit will bring any receiver C.O.D.

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S 38	$ 47.50

W2MEI W2MYY

W2JRF W2PBM

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3.5 — 54 MC.
Plate Modulated
36 Watts, Phone, CW.

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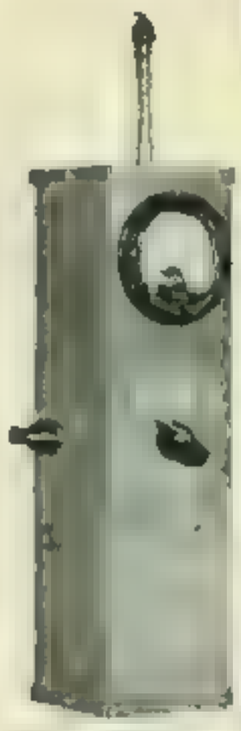

Sensitive Field Strength Meter 8 BANDS switched 3.5-148 Mc. 29.95

Famous Two-way Handy-Talky 144-148 Mc. using those 50 hour batts 34.50

Smallest Converters 10-11 or 6 meter bands $29.95

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Any number coils connect together with 83-1J connectors (below)

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Extra Connectors
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Choice Each... 35c

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200 ohm D.C. resistance, 2000 V. RMS. Size 3⅜" sq. x 4⅝" high. Wt. 5½ lbs. Has 12" leads at side.
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YL of the Month

Speaking of "firsts," firsts are nothing new to Theresa McLaughlin, W3VYU, of Greensburg, Pa. Terry was always "the first girl I ever knew who was so technically minded" to most of her friends, and is now the first girl to graduate from Carnegie Tech's electrical engineering school.

Only 20 years old and with an E.E. degree, Terry is working at Curtiss-Wright in Columbus, Ohio. She hopes through her work to help make flying the safest mode of transportation.

Terry has been intensely interested in the radio field since she was 14, when she saw a Pete Smith movie short about hams. That same year, while attending high school, she studied for and passed her exam. Before long she was ORS, EC, and had been nominated for the Hiram Percy Maxim Award as the young amateur to accomplish the most that year.

During the war Terry was able to combine in CAP work her two main interests of electronics and flying, serving as communications officer in charge of an all-girl flight group. About this time she also had received her private pilot's license, her first and second-class radiotelephone commercial licenses, and was working in her "spare" time as an engineer at WHJB in Greensburg.

Terry never lacks for things to do. "Besides my present opportunity to work with my first love, radio control and robots, as engineer at Curtiss-Wright," she says, "I'm working for a commercial pilot's license with a couple of ratings on the side. Have a little 25-watt transmitter here as well as my trusty Sky Champion, and will be having skeds back home. There's also a chance here to get a master's degree . . . "

Terry has made many friends on the air and says: "I was always bumping into pals on the bands when I least expected to—just happened to park on their frequency and hear them calling me. Strangest one in that category was the nignt I was in W8IYI's shack (now W3LEJ) and heard someone sending a test from my station! Thought at first it was spooks; it is peculiar to hear one's own call being sent when there one sits somewhere else. It turned out to be one of the boys who had stopped to check my rig which had developed a little quirk, and since I wasn't there he had been admitted to the shack anyway and decided to give it a test.

"I also met on the air some blind friends to whom I now write regularly in Braille. Radio also gave me an interest in cryptography, after a course in the AARS."

Terry seems to be not only the "firstest" but also the "mostest" in the way of interests. So outstanding have been her accomplishments, in fact, that she has been selected for a feature write-up in a fall issue of *Parade*. We suggest you watch for it.

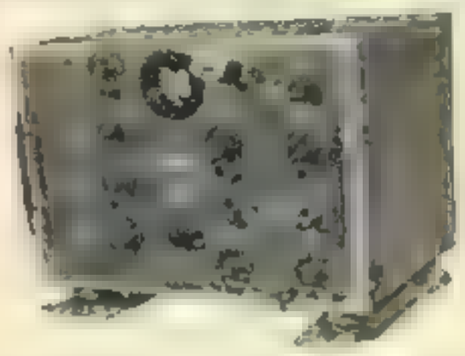
THE L NETWORK

(*from page 40*)

network is inversely proportional to the capacity, whereas the inductance is used to bring the circuit into resonance. Hence, if the tank condenser is used for dipping the circuit, the loading on the Class C amplifier is being varied simultaneously. In case a tapped inductor is used instead of a "roller" coil, it will be necessary to cross-juggle capacity and inductance until the proper degree of loading is achieved, observing as closely as possible the circuit principles as outlined above. (*Continued on 84*)

HOT RADIO VALUES at Sun Radio

100 WATT BENDIX TRANSMITTER TA 12



CHECK THESE VALUES: Three 807 Tubes, four 12SK7, one 2 inch 5 amp. RF meter, four separate master oscillators.)These can be easily changed to cover 20-40-80 meters and by using crystal for the 10 meter band you will have a complete coverage transmitter.)

Four separate output tanks.

One 4 position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11 x 12 x 15 inches, weighing 35¼ lbs. Complete, simple instructions for conversion furnished. Complete with tubes.. **49.95**

SUPERHETERODYNE RECEIVER.

This crystal fixed frequency receiver comes with full conversion instructions for variable tuning of all ham bands and broadcast. A highly selective superheterodyne receiver, 110 V.A.C. power supply built in. Using the following tubes: 6K7-RF Amplifier; 6K8 Output and Noise Suppressor; 80 Rectifier. Dimensions—3½ x 19 x 11½ inches. Comes complete, brand new, with one set of coils and two sets of tubes **16.95**
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A heterodyne frequency meter complete with tubes, crystal, calibration chart and guaranteed accuracy of .01% or 500 cycles, whichever is greater. Better than two dial division per kc. Fundamental ranges are 125-250 and 200-400 kc. volts AC power pack, batteries or vibrapack. Makes a fine signal generator or converts to VFO. These are slightly used but Guaranteed A1 . . . . . **37.50**
. . . . . With Modulation $54.50

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Guaranteed excellent condition. It is a Hot receiver for Ham and Television experimenters, tunes 174 to 210 mc, contains 2 R.F. and 5 I.F. stages. Complete with 110 volt AC power supply and 14 tubes. **39.95**

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Ideal for Ham and Police.... **14.95**

BC645 UHF RECEIVER TRANSMITTER

"The citizen's Radio" covers 420-450 mc. Consists of complete transmitter, modulator system and receiver, 15 tubes, and simple complete conversion instructions for 420 mc operation. Brand new **14.95**

D.C. MILLIAMMETER

Brand new General Electric 2" round panel meters 0-300..... **2.97**

BC-684 F.M. 35 WATT TRANSMITTER

BC-684 F.M. 35 WATT TRANSMITTER Brand new, complete with eight tubes, crystal control, 10 channel pushbutton, nonlinear modulation coil... less coverplate, crystal and power supply.. **17.95**

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SCR536B1 Handy Talkies, Brand new, complete chassis including tubes for replacement in the Handy Talkie. Also suitable for portable receiver by making necessary changes. I. F. transformers are 455 kC iron core. each..**14.95**

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5U4G **.49 ea.** 6AG5 **.59 ea.** 6SN7GT **.39 ea.** 6E5 **.59 ea.**
2X2/879 **.80 ea.** with socket, plate cap and insulator **$1.30 ea.**

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All have 115 or 117.5 v. 60 cycle primaries.
All are metal cased with ceramic stand-offs.

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1650 No. Damen Ave., Chicago 47, Illinois

So far, we have considered the case of a quarter-wave antenna with a theoretical impedance of 36 ohms. If this were the only possible application, the circuit would not offer much attraction. Let us investigate its use in a portable rig which is to operate on 80 and 40 meters and is to use a wire strung to a convenient tree.

Let us stipulate that the antenna used will be less than a quarter wave long for the highest frequency that is to be used. There is a two-fold reason for this: One, inductance in series with the antenna will resonate it; two, the impedance will be less than 36 ohms. (This is essential since the network is only suitable for low impedances.)

In *Fig. 3*, *L* represents the inductance necessary to resonate the antenna and the inductance of the matching network. It is obvious at a glance that they can be combined, and the actual circuit will be the same as *Fig. 2*. The only difference is that the total amount of inductance will be greater than that given in *Table 3*, and hence the capacity required will be somewhat less. Since both the capacity and inductance are variable, an impedance match can be achieved over a wide band of frequencies with a wide variation in antenna resistance and reactance.

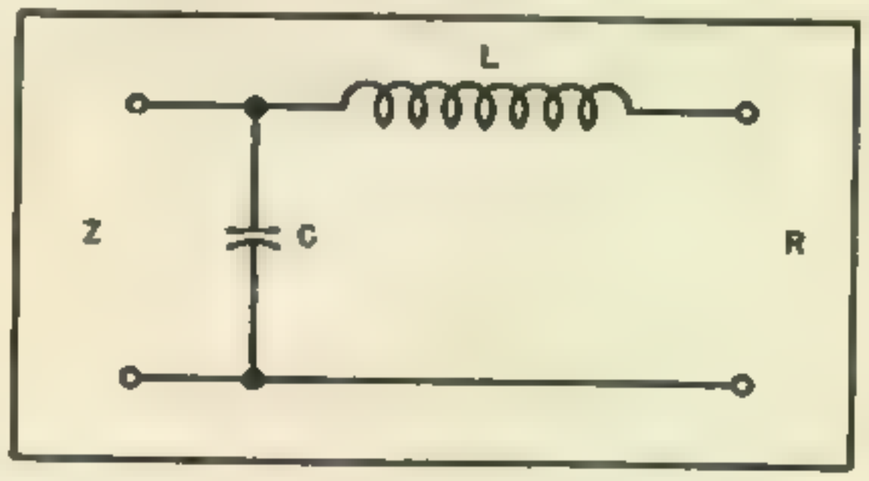
Appendix

$$X_L = \sqrt{ZR - R^2} \quad \text{ohms.}$$

$$X_C = \frac{ZR}{\sqrt{ZR - R^2}} \quad \text{ohms.}$$

$$L = \frac{159\ X_L}{f} \quad \text{microhenries (f in kilocycles).}$$

$$C = \frac{159{,}000}{f \times X_C} \quad \text{micromicrofarads (f in megacycles).}$$



PROBLEM: To match a 100-ohm feed line to 5 ohms at 14 mc.

$$X_L = \sqrt{100 \times 5 - 25} = 21.8 \text{ ohms.}$$

$$X_C = \frac{100 \times 5}{21.8} = 22.9 \text{ ohms.}$$

$$L = \frac{159 \times 21.8}{14{,}000} = 0.248 \text{ microhenries.}$$

$$C = \frac{159{,}000}{14 \times 22.9} = 496 \text{ micromicrofarads.}$$

The arrangement illustrated in the appendix where *C* is across the load and *L* in series with the load will only match a transmission line to a load whose impedance is less than the surge impedance of the line. In the case where the impedance of the load is greater than the surge impedance of the line, *C* goes across the load, rather than across the transmission line, that is, at *R*.

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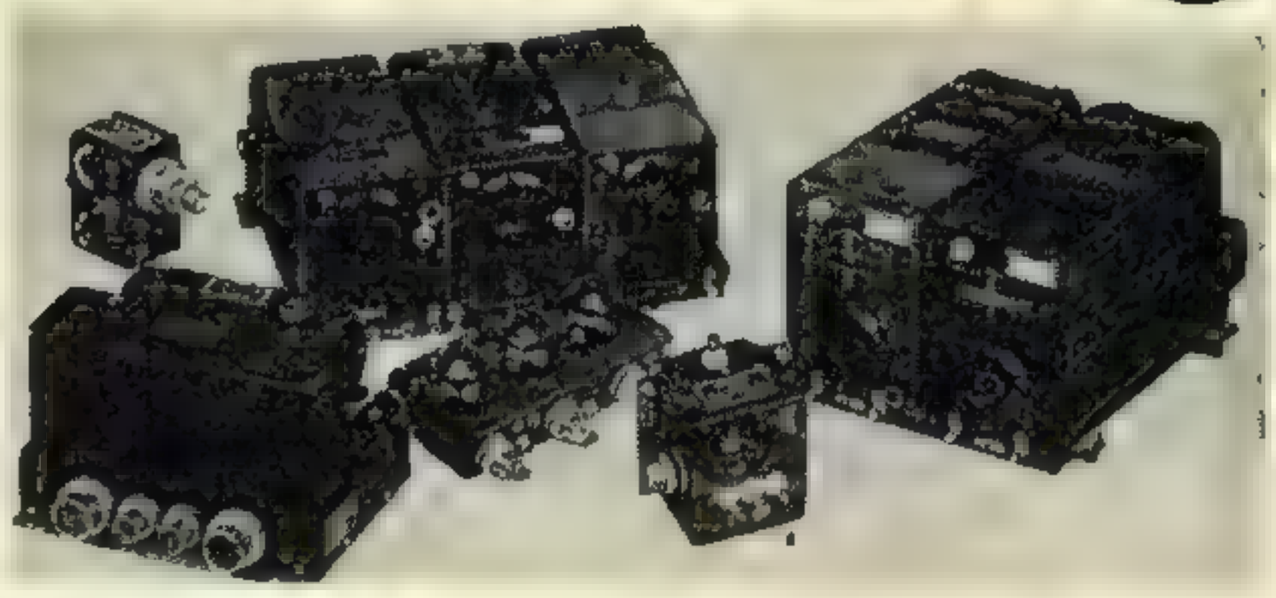
10 Meter Mobile Rig

War Surplus SCR 274N Complete

$19.50



The SCR 274N Command Set, as supplied with our Conversion Book*, is easily, inexpensively, converted to:

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- 20 meter band
- 40 meter band
- 80 meter band

This war surplus sensation is not only an ideal 10 meter mobile rig—it's a complete amateur station! Besides uses above, equipment included in Command Set makes swell standby receivers (with BC-348)—increased RF output of other xmtrs (VFO driver stage gives a BC 375E RF output wallop up to 150 watts). Slightly used, in excellent condition—*guaranteed operative.*

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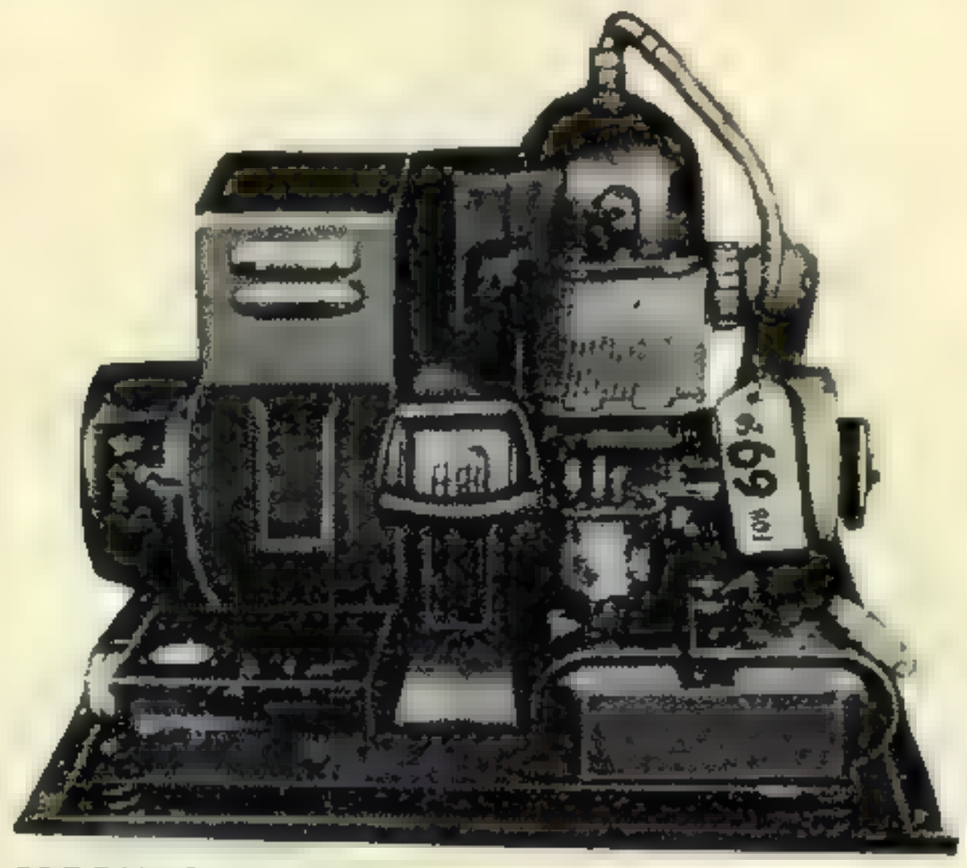

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- Amateur Radio power supply
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- Power farm equipment
- Welders
- Starting airplane engines
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- Govt. designated HRU-28, Commercial C-10A
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- 1 cyl.-2 cycle gasoline motor
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- Width—17½"
- Height—21½"
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- Voltage regulator—12 to 35 volts

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Special 8 mc. xtals for 2 meter xtal control, only..$1.50

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In the photograph the D & L Adapter shown is approximately ¼ actual size. Here are some of its outstanding features: Eliminates QRM, rejects AM signals in FM switch position, tunes to any IF frequency between 425 and 475 kc., uses 6AG5 Limiter and 6H6 in special phase shifting circuit..... $15.45

AMATEUR NET PRICE.....

See your Jobber today or write direct for further details.

D & L

ELECTRONIC DEVELOPMENT CO.

5302 Virginia Avenue Hollywood 27, California

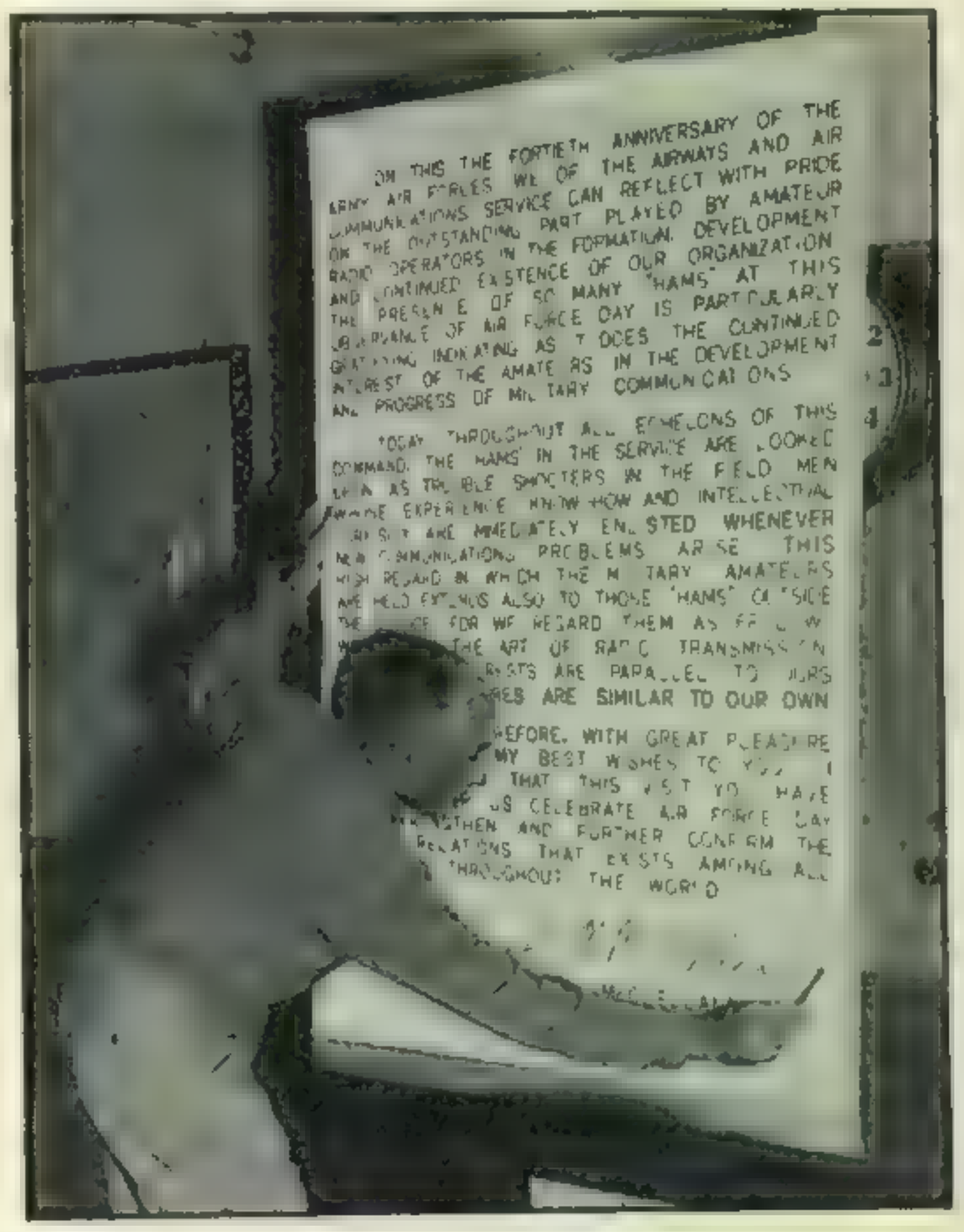
TABLE TOP TRANSMITTER

(from page 43)

A simple modification of the circuit shown permits the use of one switch for break-in operation. A DPDT toggle is substituted for the SPST controlling the primary to the 815 final. One side of the DPDT switch is used to close the primary and also to supply 110-volt a.c. through two terminals on the rear of the r-f chassis to energize an antenna relay coil. The opposite side of the switch, and the opposite poles connect to the receiver break-in terminals. One switch can then be employed to turn the receiver off and the rig on, changing the antenna simultaneously. For c-w operation a key is inserted in the closed circuit jack, breaking the oscillator cathode circuit. Since both the doubler and the final employ cathode bias, break-in keying is practical. The PHONE-C.W. switch shorts out the modulation transformer secondary and opens the filament circuit of the speech tubes and modulator when placed in the C-W position.

Typical current readings for all stages are: oscillator plate, 35 ma; doubler plate, 45 ma; final grids, 3 ma (pair); final plates, 150 ma (pair).

There are about fifty of these transmitters dotting Southern California, all of which originated from this model. Results have been excellent and they more than hold their own from 10 to 80, on both c.w. and phone. They also serve as an excellent driver for high-power triodes. Where space is at a premium, or for general utility work, the 815 combination is unbeatable.



Major General Harold M. McClelland, Commanding General of the Airways and Air Communications Service, A.T.C., affixing his signature to his Air Force Day greeting written to all hams.

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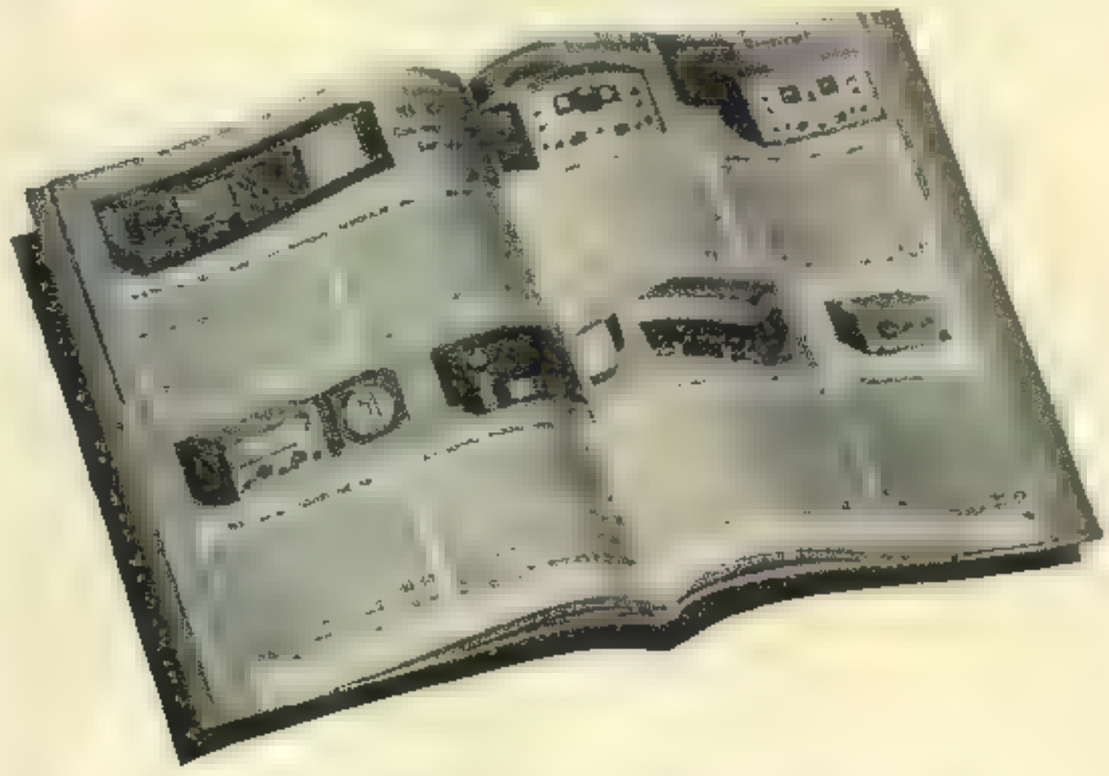

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ZERO BIAS

(*from page 13*)

do not yet exist, the amateur is in for trouble. It is unlikely that hams can expect relief from TV stations going QRO for at least five years.

But weak signals come also from a variety of other things. Poor installations are a major source of TVI. It is not uncommon to see two-thousand-dollar television receivers being fed from an antenna not worth ten dollars. Even the best commercial antenna now available for TV sets is not sufficiently broad band to be good on all channels. A high-gain receiving antenna good on more than one or two channels is not yet in existence. All these shortcomings place the onus of clearing up the interference directly on the amateur, when it is definitely not his fault.

But we are losing track of the main theme of this editorial. The technical aspects of TVI are under investigation from many sources, but more need be said about the social aspects of the interference. We feel that a good percentage of the TVI now being experienced is not the fault of the ham. Despite the tremendous investment in money, the TV installation can be compared to an a.c.-d.c. midget insofar as its ability to discriminate against unwanted signals. We can conclude that the ham is right in the majority of cases—but we're still wrong. We are in the unhappy situation of being a minority in the right. A little bit of legislative hocus-pocus and we would be a minority in the wrong. It would be sheer naivete to believe that commercial interests won't attempt to have the amateur source of interference legislated out of existence if that happens to be the least expensive solution to their troubles. There is a colossal dollar investment in television and no one, regardless of his sentiments about ham radio, is going to jeopardize the investment if it is his stock and trade.

When this argument is broached the average amateur brings up the fact that hams are not the largest single source of TVI. True as this is, the amateurs are one of the principal sources that can be handled as a body. The diathermy machines now raising havoc, the noisy auto ignition systems—these are things pretty well beyond the reach of the legislator, at least in time to do him much good. The CAA could easily become a party to this controversy since we saw several installations knocked out of synchronization by aircraft flying overhead.

It becomes apparent that, despite all the work being done by amateurs and industry, there is no cure-all for TVI. The ham must, therefore, adopt a program of diplomacy. When service organizations blame the amateur it is his job to attempt to explain our position to the set owner for the sake of the hobby. Nothing is to be gained by blasting a local radioman even if he is wrong. If the reasonable approach doesn't work with a set owner, a nasty one certainly won't. The service organization should be visited and every offer of cooperation made. If they refuse, you have ammunition in your dealing with complainants. One of our friends connected with the F.C.C. coined a phrase that best sums up the entire

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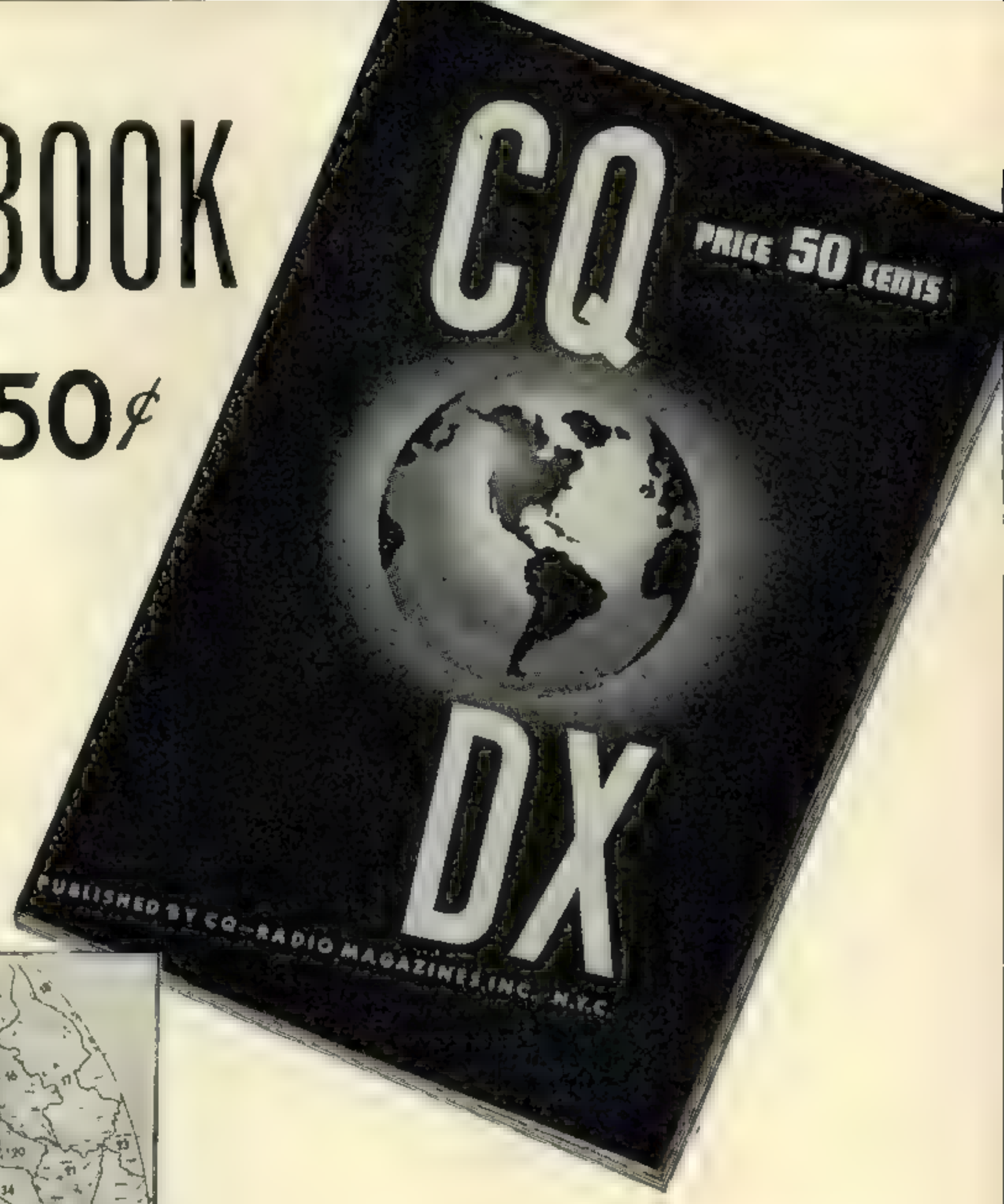

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situation. He said what too many amateurs lack is "threshold diplomacy." Instead of trying to emulate the cab driver who just got cut off by a truck, use a little threshold diplomacy. No one likes to be told his five-hundred-dollar investment in a TV set was wrong. The local radioman is out to make a living. Somehow or other, until a technical solution is reached, it is up to the individual amateur to reconcile the seller and buyer of the TV set to a program of cooperation. We musn't let ham radio get a poor name for itself. Threshold diplomacy is the thing.

—W2IOP

SCRATCHI

(*from page 8*)

goings on. This okeydokey with me, as I are figuring that when Itchi reely examine what he has bought, he will give it to me. I, of course, are being very carefool in my purchases, only buying things I figure I be using, or stuff that are too cheap to pass up. Ho, ho, good joke. Everything I see I figure I can be using or it are too cheap to pass up. So, Itchi's station wagon are pretty well loaded on weigh back from coast.

Itchi and I are spending the next day unpacking everything. When I are only half-way through unpacking boxes, I find I have receivers which can cover from 50 kc on up to mikrowaves and then sum. There are being a few spots above 1000 mc where I are not able to tune, but figure that it should be no job to change frequency slitely by pruning the coils on sum receivers. One box are containing all kinds meters with all kinds of marking. They are reading "Flaps Up, Flaps Down"; Left-Bank, Right-bank"; "Empty, Half, Full", etc. I are already thinking of good place for last meter. Such enjoyables as I are having unpacking boxes right and left!

Hon. Ed, I are having something of everything there is, even including filter capacitors. This are probably a foolish thing to be buying, as if I add any filter capacitors to my final power supply, are getting rid of that distinktive note which I are getting so many compliments on. All this time Itchi is unpacking what he bought, I are not paying too much attentions, except to noticing that he has sum selsin motors, a cupple of walkie-talkies, and sum reduction gears. (I are careful not to let him know I looking, as maybe he are going to make me a present of a new rotary beam.)

Scratchi are wakened up at 9 ayem next morning by most peculiar whirring sound that are sounding like single-engine airplane with one propeller missing. I are rushing out into patio and there are Itchi reclining in beach chair, with a black box in his lap. Out on lawn are a lawn-mower going back and forth, with a small vertical antenna on handle. Hon. Ed.. you would be the most surprizing person if you could seeing Itchi's arrangement. He are fixing up lawn-mower with heavy-duty selsin acting as motor for blades. Another selsin are attached to little steering wheel on back like little airplane control wheel. These are connected to walkie-talkie unit which Itchi are converted over for receiving coded signals from the walkie-talkie in his lap. He are even using a "Left-bank, Right-bank" meter like mine to showing which way lawn-mower are going when can not be seen by Itchi. When I first come out of house Itchi are making lawn-mower go in figure-ates just

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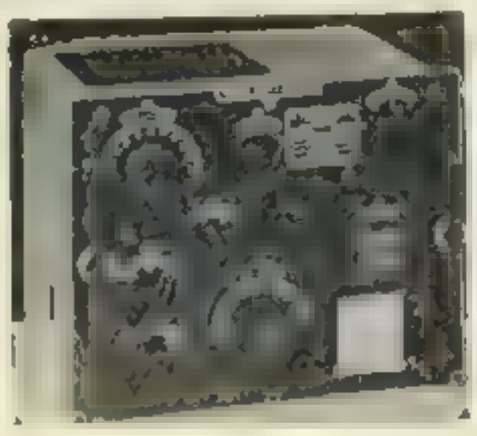

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to see how good he can run it from remotes control.

So, it looks like Scratchi is going to have to build his own new rotary beams, as Itchi are figuring out fancier way of using his stuff. Anyway, I are going to have to start to work of building an addition to shack, as haven't room for all new equipments. I are letting you know when I get things in A-1 1/c shape.

Respectively yours,
Hashafisti Scratchi

LIFE INSURANCE

(from page 37)

of these effects, unfortunately, is not general and the impression which prevails is that if a victim survives an electric shock there are no subsequent sequelae to fear. Such is definitely not the case.

Most of us at one time or another have contacted a conductor inadvertently and have received a so-called "nip" or "bite". How many of us considered the possibility that these *painless* shocks may have very serious after-effects? McFarlan[5] points out that one of the most seriously incapacitating and most common delayed results of electric shocks of "house circuit" intensity is a wasting away of muscle (atrophy) in the limb involved. This is caused by the effect of the current on the delicate nerve cells in the spinal cord. It is a slow, progressive, and intractable disturbance and may not appear for weeks or even months after the date of the contact. Other reported delayed reactions are insanity, personality changes, amnesia, mental inertia, diseases of the blood vessels, eye cataracts, nerve disturbances of varied natures and disturbances in the heart conduction system. It can now be seen why electric shock is regarded as a real industrial hazard

A relatively new complication of electric shock has been brought to our attention by Glazer[6]. He records three separate cases in which extensive destruction of the tissue of the pancreas had been found at autopsy. While it is unlikely that the immediate death would be from this cause, it is well known among physicians that pancreatic destruction, regardless of the cause, is attended with an extremely high mortality rate.

When Electric Shock Occurs

A big question in our minds is what should be done for a victim rendered unconscious by electricity? Too often, accidental electrocution has been considered solely a problem for a physician and much precious time has been lost by waiting for one to arrive at the scene. In the meantime, however, the victim has died, because nothing was being done for him.

The death rate in accidental electrocution can be lowered only by the layman. Fortunately, the *most effective* treatment for electric shock so far known is artificial respiration by the prone pressure method. It exceeds the efficiency of pressure operated mechanical respirators which, if used by unskilled operators, can do considerable damage and even cause death. Every radio amateur should acquaint himself with the Schaefer technique of artificial respiration. Lives of radio amateurs have

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been lost because of the ignorance of this simple procedure.

To be effective, artificial respiration must be applied as soon as possible after the victim is rendered unconscious. One precaution should be taken and that is preventing electrocution of the rescuer. Break the lethal circuit as quickly as possible. If you are alone with the victim *do not* take time to send for help, but immediately apply artificial respiration and keep doing so uninterruptedly. Shout, whistle or scream to attract attention for more help, but do nothing that will interfere with the rhythmic motions of artificial respiration. In a case like this—you and you alone can save another person's life—do not become panic stricken. If the victim can be resuscitated, you can do it as well as anyone else.

Never take the responsibility of pronouncing a victim dead because he is not capable of breathing of his own accord—to do this makes one guilty of a crime just short of murder. There are cases on record in which artificial respiration has been continuously applied for as long as 8 hours before the victim was able to resume normal respiration. In the average case of unconsciousness due to electric shock all signs which ordinarily would indicate death will be present. They are lack of pulse, absence of heart beat, no response to stimulations and no respiration. Even though all these signs are present, the victim may still be alive and artificial respiration is the only way in which he can be kept alive until his body processes are capable again of functioning.

The only absolute sign of death in a body rendered unconscious by electric shock (or by drowning or gas asphyxiation) is the appearance of rigor mortis (a post-mortem phenomena due to coagulation or jelling of protoplasm). It is a sign only to be interpreted by a physician or one acquainted with such phenomena—until this sure evidence of death occurs there is a possibility that the victim may be revived. Never try or attempt to administer stimulants or water by mouth to an unconscious person, because the swallowing reflex will be absent and anything given by mouth will go directly into the lungs, further lessening the victim's chance of recovery.

In an unconscious state where there is no heart action or respiration, death occurs in about 5 minutes because of the lack of oxygen and subsequent damage to the body cells. For this reason it is extremely important to start artificial respiration as soon as humanly possible. The highest percentage of recoveries exists in those cases in which artificial respiration was started almost immediately after the accident. The number of successful recoveries obtained after 3 minutes is markedly reduced and if artificial respiration is not started before 5 minutes have elapsed, death will surely occur.

Conclusion

The main causes of death in electric shock are ventricular fibrillation, respiratory center paralysis or a combination of both. Currents at ordinary household voltages and frequencies are considered to be the most dangerous. The amperage of the current and the path it takes through the human body are the most important factors to consider in the severity of an electric shock. There are serious

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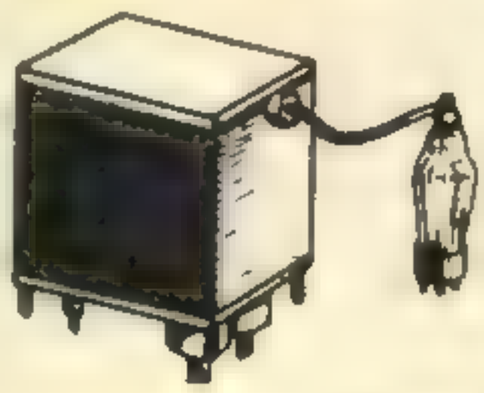

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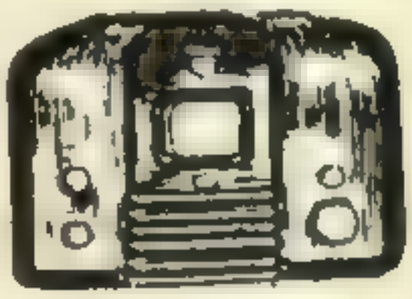

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latent effects of electricity which may well be incapacitating. Artificial respiration is the most effective means of reviving a victim and it must be applied promptly and continued until there is no question of death. Consider any potential above 25 volts as dangerous to human life and never wilfully subject yourself to electric shock.

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LETTERS

(*from page 6*)

I was a service clerk in the Communications Command Seventh Fleet for some time during the war. It is the duty of the service clerk to request repeats, send out corrections and, if possible, to catch such pineapples as the 105 NYs before any damage is done.

It has always been fascinating to me to see how a few misplaced dits can turn a good message into a monstrosity that Ripley would be proud of. A classical example of this was a dispatch received by us to be passed to NTF (Radio Manus). Since we were not addressed we did not decipher the text, which would have saved a big headache. Our re-

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

of CQ, The Radio Amateurs' Journal published monthly at New York N. Y., for October 1, 1947.

State of New York } ss.:
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Sanford R. Cowan, who, having been duly sworn according to law, deposes and says that he is the Publisher of CQ, The Radio Amateurs' Journal and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are: Publisher, Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.; Editor, John H. Potts, 1737 York Avenue, New York, N. Y.; Managing Editor, Lawrence Le Kashman, 261 Central Ave., Lawrence, N. Y.; Business Manager, Sanford R. Cowan, 1620 Ocean Ave., Brooklyn 30, N. Y.

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) SANFORD R. COWAN, Publisher.

Sworn to and subscribed before me, this 18th day of September, 1947.

(Seal) HARRY N. REIZES, Notary Public.

Notary Public in the State of New York. Residing in King's County. Kings Co. Clk's No. 634, Reg. No. 612-R-9 N. Y. Co. Clk's No. 779, Reg. No..... Term expires March 30, 1949.

ceiving operator dropped the time zone suffix, which wasn't always present on messages, from the date-time group and stuck it in the address. This made /ZNTF, which would have been an obvious error and a repeat would have been requested. However, he went one step farther and copied the TF as a slant sign, making the address read /ZN/. Oddly enough, this was the cryptographic call sign of a PT boat in our area. It must have been a pretty baffled skipper who read the message and learned a whole battalion of SeaBees was moving in on his little craft.

I don't know whether or not such incidents are of much interest to others, but I get quite a kick out of them. Maybe some other readers have similar stories to tell.

James E. O'Brien

SIMPLE MEASURING EQUIPMENT

(*from page 31*)

Constructing a Dummy Load

The strip or "dagger" is made from volume control strip having a resistance of 200-ohms per square. Care must be taken to cut the resistor strip material so as to clean and smooth edges and to have a very sharp point. The squared end may be fitted with a wood or fibre handle which dimensions are shaped to cause a fairly snug fit into the waveguide which is being measured. With a little practice "matched" loads can be made which will reflect back but very little energy and absorb practically all of it. It is assumed for amateur and similar experimental work that a resistive load having a V.S.W.R. of 1.02 would be acceptable, and may be obtained by careful adherence to the dimensions given in *Fig. 4*.

Fig. 5 shows a simple "traveling detector" with which the magnitude of the S.W.R. of a transmission line may be indicated by noting the voltage maximums and minimums as the crystal probe is moved along the slotted waveguide section. In actual operation, this method was able to distinguish between a V.S.W.R. of 1.01 and one of 1.06.

We have been discussing the time worn problem of matching a radiating system to a transmission line, and it is not to be construed that this is the only source of mismatch and therefore the only contributing factor to high standing wave ratio in a line.

Other Causes of Impedance Mismatch

The problem of joints, for example, in a waveguide type of transmission line can be much more bothersome than joints in lines carrying lower r-fs. Considerable care must be given to providing good alignment as well as tight joints between various "plumbing" components in order to reduce both reflections and loss of power. When starting with a signal source which has an output of but a few milliwatts, one is especially well repaid by painstaking procedures. Like in other forms of "plumbing," leaks (r.f.) in microwave plumbing are just as undesirable. Again we can bring into play our field-strength meter as shown in *Fig. 2* to explore about the waveguide joints and along the line itself for stray and unwanted r-f leakage.

The three types of connectors or flanges most commonly assembled on waveguides are choke

(*Continued on page 99*)

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flanges, plate or cover flanges and contact flanges. Choke flanges are useful inasmuch as they permit a limited amount of misalignment without causing too high reflections and they may be spaced further apart than other types of flanges with the same loss of power. Another characteristic which might be considered is that the dimensions of the choke groove are specified with a definite working frequency in mind and therefore the choke flange is not considered a broadband device. Many of the choke flanges now found on "surplus" components were designed to work at a frequency considerably lower than the amateur 10,000—10,500 mc band. The choke flange is also more expensive than other types, and for the reasons given it is assumed that they will not be as popular with amateurs and other experimenters as the cover and contact type of flanges. The three types of flanges under discussion here are shown in *Fig. 6.*

The choke flange was intended to mate with a cover flange, but if two clean, flat cover flanges are aligned and tightly bolted together, they may well contribute less to the system's standing wave ratio than joints where choke flanges are used. In some cases contact flanges which make a butt joint with each other are superior in respect to V.S.W.R. and loss as compared to the other combinations already discussed, but again, it is imperative to have the flanges and guide precisely aligned and pulled together tightly.

The above precautions are not difficult to observe and one does not need to be discouraged by new and interesting problems. Admittedly it helps a lot in this microwave work to be an engineer but one can still have a lot of fun as an average amateur. And there are still lots of things to be discovered in this part of the radio spectrum.

THE VARIF

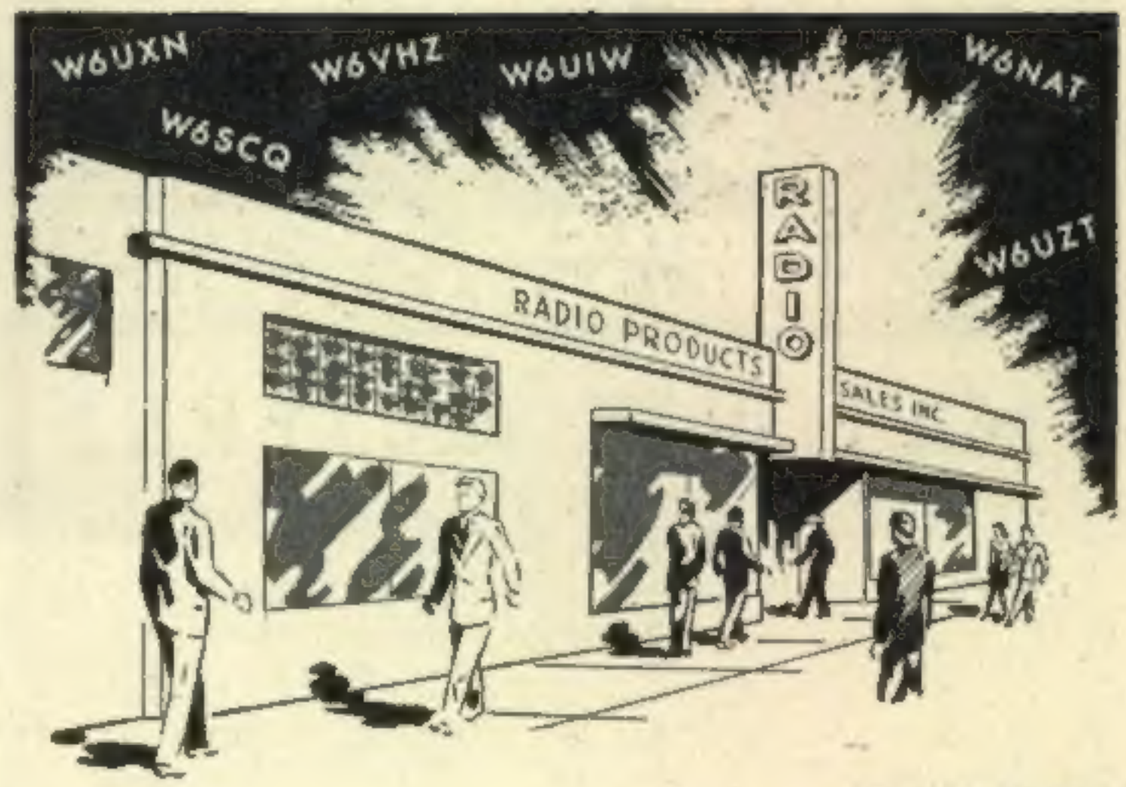
(*from page 19*)

voltage. Since this is also very desirable for mobile operation it was decided that the voltage regulator should be mounted on the main receiver chassis.

After Thoughts

No particular difficulties should be encountered in aligning the Varif. The units with the parts values given will give a selectivity range of from 50 to a little over 500 kc. Recent work on the i-f amplifier indicates that *R10* might be reduced to 500 ohms and C21 increased to 500 $\mu\mu$f to give a slightly greater bandwidth, the measured limits being 40 kc minimum and 750 kc maximum. These values are for zero ohms and 500 ohms, respectively, in *R10.*

There is some possibility that the 6AU6 could be substituted for the 6AS6, although this would require some experimenting in part values to obtain the ideal results when using the 6AS6. In the tube handbooks used by the authors, the base pin connections of the 6AS6 are incorrectly given. The correct base pins are as follows; No. 1, control grid; No. 2, cathode; No. 3 and No. 4, heaters; No. 5, plate; No. 6, screen grid and No. 7, suppressor. In some diagrams the suppressor and cathode pins are reversed.



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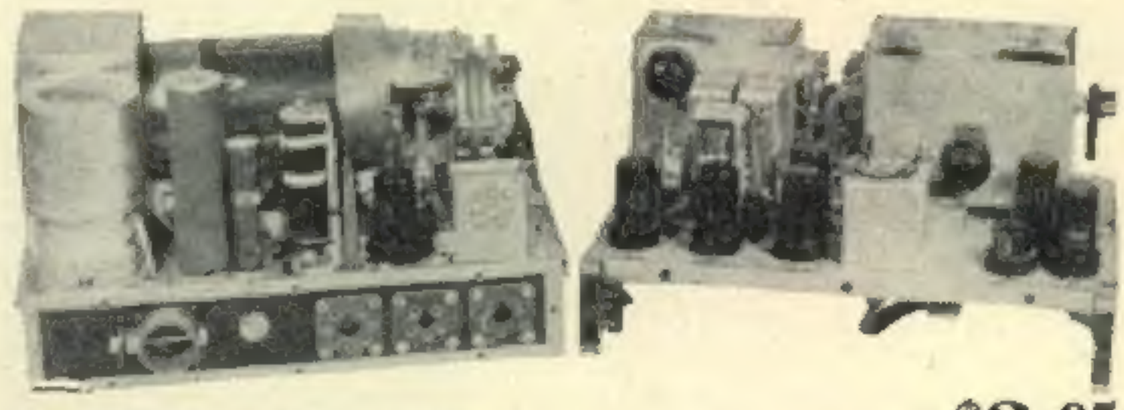

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ALLIED RADIO CORP....87
ALMO RADIO COMPANY....97
AMERICAN RADIO INSTITUTE....97
AMERICAN SALES COMPANY....78
ARROW ELECTRONICS COMPANY....81
ARROW SALES, INC....94

BUD RADIO, INC....62
BURSTEIN - APPLEBEE CO....82

CAMPBELL - FAIRBANKS EXPOSITION....93
COLLINS RADIO COMPANY....14
COMMUNICATIONS EQUIPMENT CO....91
CONCORD RADIO CORP....79
CONTINENTAL SALES COMPANY....92

D & L ELECTRONIC DEVELOPMENT CO....86

EITEL - McCULLOUGH, INC....9
ELECTRO - VOICE, INC....1
ELECTRONIC SUPPLIES....78
ELECTRONICRAFT, INC....92
ESEGE SALES CO., LTD....80

FEDERATED PURCHASER, INC....72

HALLICRAFTERS CO....4, 5
HAMMARLUND MFG. CO., INC....12
HARRISON RADIO CORP....65
HARVEY RADIO CO., INC....86
HEINTZ & KAUFMAN, LTD....57
HENRY RADIO STORES....73
HERSHEL RADIO COMPANY....77
HOWARD RADIO COMPANY....71

INSTRUCTOGRAPH CO....92
INTERNATIONAL RESISTANCE CO....64

JOHNSON, E. F. CO....34

LEOTONE RADIO CO....94

MAGUIRE INDUSTRIES, INC....10
MALLORY, P. R. & CO., INC....8
MERIT RADIO SUPPLY CO....69
MILLEN, JAMES MFG. CO., INC....6
M & H SPORTING GOODS CO....66

NATIONAL CO., INC....2, 53
NATIONAL RADIO INSTITUTE....63
NIAGARA RADIO SUPPLY CORP....88

OFFENBACH & REIMUS CO....90

PAR - METAL PRODUCTS CORP....96
PETERSEN RADIO CO....7
POSITRON, INC....92

QUAD ELECTRICAL SUPPLY....84

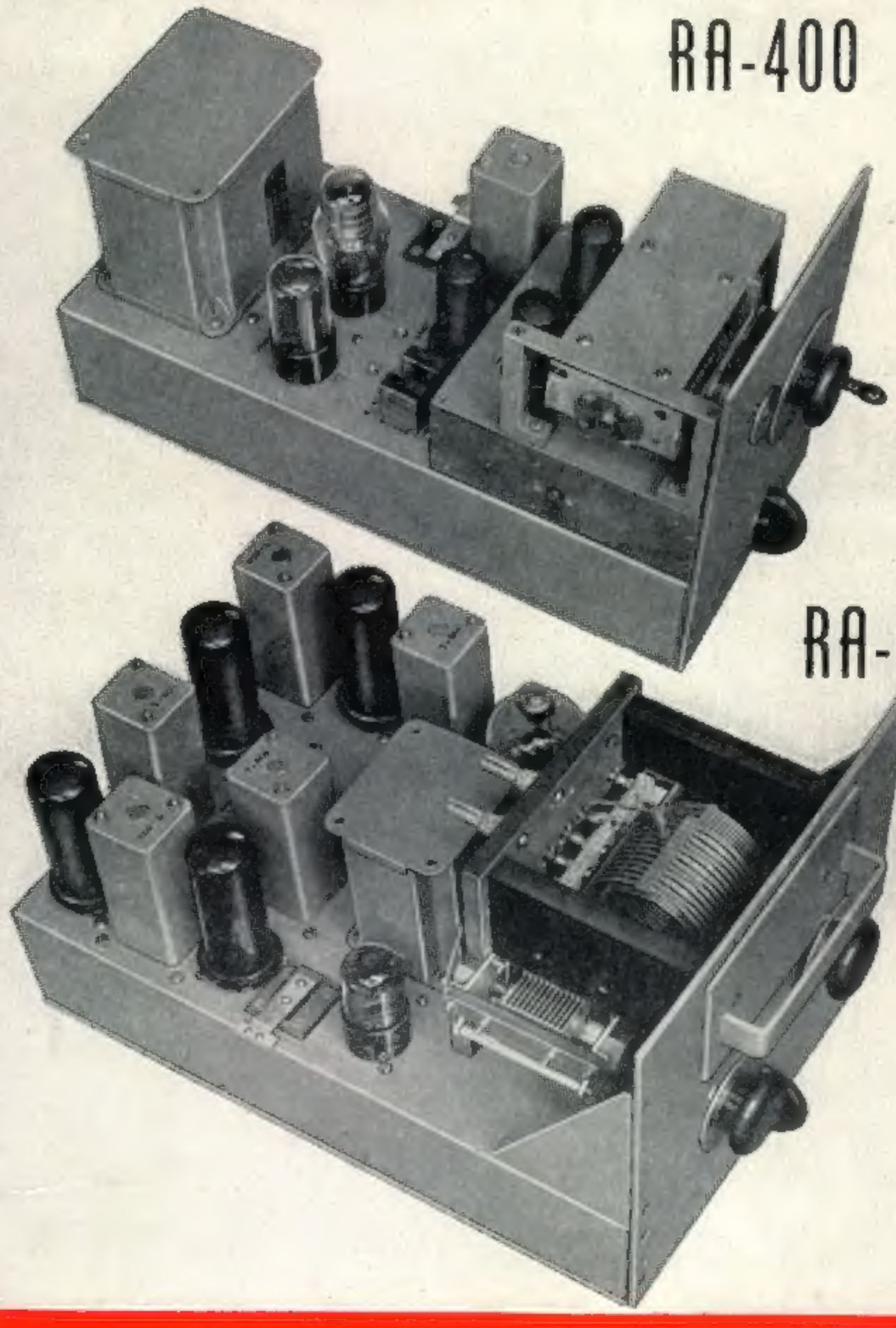
RADELCO., INC....97
RADIO CORPORATION OF AMERICA....Cover 4
RADIO MFG. ENGINEERS, INC....Cover 2
RADIO PRODUCTS SALES, INC....99
RADIO TRANSCEIVER LABORATORIES....82
RADIO WIRE TELEVISION, INC....70
R & M RADIO COMPANY....85

SAN FRANCISCO RADIO & SUPPLY CO....94
SCHUH'S RADIO PARTS....80
SILVER, McMURDO CO....59
SIMPSON ELECTRIC CO....95
SONAR RADIO CORP....55
STAHL, MICHAEL, INC....100
SUBURBAN RADIO COMPANY....67
SUN RADIO OF WASHINGTON, D. C....83
SURPLUS RADIO, INC....95
SYLVANIA ELECTRIC PRODUCTS INC....11

TAB....74
TECHNICAL RADIO PARTS CO....88
TIK....84
TRANSVISION, INC....76
TRANSMITTER EQUIP. MFG. CO., INC..Cover 3
TRIPLETT ELECTRICAL INSTRUMENT CORP...61

UNIVERSAL GENERAL CORP....90

WELLS SALES, INC....75
WESCHESTER ELECTRONIC SUPPLY CO....90



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